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The Blocking of Wet Rubber.

Some interest has been aroused by a circular published by the Peradeniya Department on this subject during January, and it has met with a considerable amount of criticism. The results were obviously of the crudest and most immature kind, and people seem to have expected finished results. The object of early publication was to prevent planters from establishing large and expensive factories for drying and otherwise mechanically treating rubber until it was certain that such treatment was of real advantage.

Even the one small shipment of wet block sent home seems to have disproved this, and attention must be again called to the fact that it was taken home personally by Mr. Brett, one of the judges at the recent Exhibition, who undertook to show it to leading manufacturers and others, and it was on the strength of his cable that the rubber was *stronger*, that it was considered worth while to publish results so early.

It must be pointed out that it this treatment comes in, the expense of, and waste of time in, drying will disappear, besides that the rubber gets a higher price. The speedier return, as against the fact that a lot of money lies idle in the drying rubber, must also be remembered.

The important point is the proof that the retention of water in the rubber may be advantageous. It now remains, as pointed out in the circular, to determine what is the best percentage of water to leave, and how best to leave always the same percentage.

GUMS, RESINS, SAPS AND EXUDATIONS.

Spiral Tapping Thirty Years Ago.

By Ivor Etherington.

Various tapping methods have been tried during recent years in Ceylon and the Malay Peninsula, and in the former country especially the older small V system has given place as a rule to the herring-bone and the newer spiral tapping. It is not much more than a year ago that the modern spiral tapping was brought out in Ceylon, and much interest was taken in the new system, and doubt thrown in some quarters on the wonderful results in yield of rubber obtained by it. The method has now been given a fair trial; and it is generally acknowledged that of the systems tried up to the present it gives the most rapid yield, and does not apparently injure the tree if worked with due caution and if the bark be not unduly rapidly stripped from the trunk, although it may prove injurious to the tree if the cortex is removed too quickly.

It is of interest, however, and it will no doubt be a matter of surprise to many to learn that this new system of spiral tapping is in reality an old method resuscitated.

It was, no doubt, an original method with the Ceylon planters who first started it some two years ago; and who gradually worked it out after considerable experimental work. But the spiral tapping was practised by the Indian rubber-collectors in the rubber regions of Nicaragua more than 30 years ago. The main source of Nicaragua rubber is the *Castilloa elastica* Cerv., and the following note on the method of tapping the trees was written over 20 years since.

"The Nicaragua mode of tapping is as follows. The collector ascends the tree by climbers or a ladder as high as possible, and then commences a series of incisions with a sharp machete or axe in one of two ways. One is to make a long vertical cut, with diagonal cuts running into it, as in Brazil. The other is by *encircling the tree with spiral cuts at an angle of 45°*; if the tree be large, two such spirals were made, either crossing or paralleled with each other. At the bottom of the trunk an iron spout is driven in and the milk is received into iron pails."

Here we find a description of spiral tapping almost exactly the same as practised on estates in Ceylon today, but apparently worked on a more drastic scale. The angle of the cut on the trunk is that generally made in Ceylon, but in Nicaragua high tapping is practised, the tapper using a ladder. In Ceylon little scoring of the trunk is done above 6 feet from the ground. The crossing of the cuts does not seem to be of much advantage and where the lines met there would probably be a waste caused by the latex running out of the channel and down the bark. Even the spout at the bottom of the spiral cut is the same as used in Ceylon today.

In a circular 1899, by the Director, Royal Botanic Gardens, Ceylon, spiral tapping for *Castilloa* is briefly referred to as follows: "Other methods are to cut spiral groves round the tree for some distance up, or to make a main channel on one side of the stem with lateral cuts leading into it. These methods are almost sure to kill the tree." This is the only reference to spiral tapping for any species of rubber tree that the writer has come across of recent date, and the system was unknown or forgotten when it was resuscitated in Ceylon a couple of years ago.

This is another instance of the modern rubber planter in the East taking up the methods of working the industry which are practised in the wild rubber regions of the Western Hemisphere. In the November *Tropical Agriculturist* the Editor pointed out that plantation rubber could probably be improved by more closely imitating the Amazon methods of preparing the raw product.

REPORT ON RUBBER IN PANAMA.

British Consulate, Panama, October 5th, 1906.

To the Rt. Hon. Sir Edward Grey.

Sir,—I have the honour to refer to Sir E. Gorst's Circular Commercial of April 28th last (13423) instructing me to report in the course of the present year as full information as possible respecting the position of the rubber industry in the Republic of Panama, the extent of the cultivation of rubber, the prospects of a supply of raw rubber, and a comparative statement as to the exports of cultivated and of wild rubber.

The botanical name of the rubber producing tree in this Republic is *Castilloa elastica*, is indigenous and grows wild along both coasts from sea level to altitudes of two thousand feet.

No statistics are available, and therefore it is impossible to furnish data respecting the number of wild trees, but the production of raw rubber from this source is more likely to decrease than to increase in the near future owing to the ruthless cutting down of the trees in order to obtain the latex, in fact, to such an extent has this been done, the wild rubber tree is nearly extinct in some districts. In Chucunaque, a region of the Darien which has not yet been explored on account of hostile Indians, it is claimed that forests of the *Castilloa elastica* are as common as forests of other trees and that some of them are of enormous size; but all attempts of the rubber hunters to penetrate the territory inhabited by the Indians have so far met with failure.

There are approximately six hundred thousand *Castilloa elastica* plants under cultivation in the entire Republic, some of them already six years old, which are not enough to increase the supply of raw rubber to any extent in the near future, It is estimated that after eight years growth, each of the cultivated trees will give from five to six pounds weight of juice the first year they are tapped, which amount is equivalent to two and a half pounds of pure rubber.

The quantity of wild rubber exported from the whole republic in 1906 amounted to 214,750 pounds in weight and all of it went to the United States of America, except 79 pounds sent to Europe.

(Sgd.) C. MALLET.

REPORT ON RUBBER IN MEXICO.

Consulate of Mexico, October 15th, 1906.

To the Right Hon. Sir Edward Grey, Bart., Etc.

Sir,—With reference to Sir Eldon Gorst's Commercial Circular (13423) of April the 28th last, I now have the honour to enclose a Memorandum on the Rubber Industry in Mexico,

There are no means of ascertaining the relative exports of cultivated and wild rubber. The Rubber Industry of Mexico has been the subject of much discussion in the United States owing to the adverse reports made by United States Consuls-General Barlow and Parsons.

I take this opportunity of forwarding a sample of Rubber made from the Guayule plant, which I owe to the courtesy of Mr Adolf Marx, and to which I have referred in a recent letter to the Principal of the Commercial Intelligence Branch of the Board of Trade.

(Sd.) LUCIEN J. JEROME,
H.M.'s Consul,

MEMORANDUM ON RUBBER INDUSTRY IN MEXICO.

I. POSITION OF RUBBER INDUSTRY.—The Rubber Industry of Mexico can be described as being in its infancy. Nearly all, if not all, the Rubber produced in Mexico is from wild plants, the *Castilloa elastica* chiefly. The *Castilloa elastica* is found in the states of Oaxaca, Chiapas, Tabasco, Vera Cruz, and in parts of Michoacan, Guerrero, Tamaulipas, and San Luis Potosi.

Several attempts, more especially in Oaxaca, Vera Cruz, Chiapas and Tabasco have been made to cultivate Rubber Trees, but so far as I am aware none have yet proved commercially successful. Unfortunately many plantations of Rubber were made use of by fraudulently disposed persons to obtain money from greedy but credulous investors, chiefly in the United States.

II. It is quite impossible to estimate the extent of land which has been planted with rubber trees, no data of a reliable nature is to be obtained. There is no Government Department of Agriculture.

III. Of recent years, a substance closely resembling Rubber is being made from a plant known in Northern Mexico as "Guayule." There are factories for the manufacture of this substance at Torreson, in the state of Coahuila; at San Luis Potosi and at Jimulco in Zacatecas and at other places in Northern Mexico.

The Guayule plant which used to grow on otherwise worthless land is now being extensively cultivated in the Northern states of this republic, so that when the estates now being cultivated with the *Castilloa elastica* yield rubber in commercial quantities, it can be reasonably supposed that there will be a continous and slowly increasing yield of rubber from Mexico.

IV. STATISTICS.—No distinction is made in Export statistics between wild and cultivated rubber. The Mexican Fiscal Year commences on July 1st and ends on the following June 30th.

Fiscal Year 1902—1903.

Country to which exported.	Quantity Kilogrammes.	Value Pesos.
Germany	17,469·700	34,155·40
Columbia	456·000	535·00
United States	152,222·000	233,839·20
France	24,348·409	55,763·00
Holland	361·000	700·00
United Kingdom	29·000	20·00
Klgs...	194,886·109	$ 325,012·60

Fiscal Year 1903—1904.

Country to which exported.	Quantity Kilogrammes.	Value Pesos.
Germany	48,364·000	69,808·00
Columbia	2,028·000	3,271·00
Spain	99·000	160·00
United States	245,083·500	416,431·60
France	11,596·000	29,406·00
United Kingdom	549·000	1,140·00
Guatemala	84·000	175·00
British Honduras	241·000	275·00
Panama	28·000	100·00
	308,072·560	$ 520,766·60

Fiscal Year 1904—1905.

Country to which exported.	Quantity Kilogrammes.	Value Pesos.
United States	362,710·098	565,575·49
Germany	117,439·690	113,423·00
France	10,349·000	28,254·00
Spain	616·000	1,200·00
Panama	5,989·000	9,036·80
United Kingdom	92·000	350·00
Italy	308·000	985·00
Klgs...	497,503·788	$ 718,824·29

(Sd.) LUCIEN J. JEROME.

ANNUAL REVIEW OF THE INDIA RUBBER MARKET 1906.

By S. FIGGIS & Co.

PLANTATION RUBBER GROWN IN CEYLON AND BRITISH MALAYA.

The rapid increase of supply has been beyond expectation—probably 160 tons Ceylon and 350 tons Malay, against in 1905—70 tons Ceylon and 75 tons Malay. The preparation and quality, as a whole, has been excellent and suitable to manufacturers, who have paid high prices for fine lots of nice colour and transparency when clean and resilient. Planters have also done wisely in making the greater part of the scrap into washed pressed crepe, resulting in higher average prices than was realized for the scrap. The fine pale crepe is much liked. From Ceylon the greater part has still been in "biscuit" form, but we had a little sheet. From the Straits (Malaya) the greater part has been in sheet, rolled and clean, but some rather dark and mouldy of dull colour, probably from having been packed damp; we had some nice lots of crepe.

If it is decided to ship much in the form of pressed block or slab, we suggest blocks of not exceeding 3 inch thickness, and about a foot long, and expect the manufacturers will prefer the block not to exceed 10 pounds, and the cases in which it is packed of about 1 cwt. each. "Worm" rubber has only come in very small quantities, and is liked when clear and bright.

The exhibition held in Ceylon in September was most interesting and useful, and plantation rubber of all descriptions was nicely shewn. We contributed a case of specimens of most varieties of rubber, and presented it to the Government of Ceylon for their Museum. No doubt planters learnt much from it, but we do not believe that we can indicate from Europe much improvement in the mode of preparation or cultivation of rubber, beyond the general advice we have repeatedly given to:—

Pack it in good dry condition (excess of resin much objected to.)

Into strong cases of 1 cwt. to 2 cwt. each. No paper, Fuller's earth, etc. to be used.

Keeping different qualities and colours separate, and not to mix immature rubber with older; to pick out and send separately dirty barky pieces.

To smoke the rubber when convenient, because "smoking" appears to increase its resiliency, but keep it as clear and yellow as possible.

Our London charges are very small. Brokerage ½ per cent. All samples are paid for, and the only deduction is—Discount 2½ per cent. Draft (on all rubber) ½ per cent. Planters get these back in the higher prices obtained.

As we anticipated in our last annual issue, the extra price of plantation fine compared with Para fine has diminished with the larger supply of plantation, and may be expected to more nearly approach the fine Para price when supplies of former get much larger. So far, plantation has not gone into consumption for the larger uses of rubber, manufacturers having refused to pay a premium for it except for special purposes, mainly solution; no doubt when supply increases, manufacturers will use it for their larger trades. Rambong has been in small supply and sold well. Castilloa and Ceara in only small quantities, sold well; some fine realised high prices.

Last January fine sheet and biscuit plantation realised 6s 1d to 6s 1¾d, crepe dark to good 5s 7¼d to 6s 1¾d, scrap 4s 11d to 5s 4d, scrap dark and dirty 3s 4¼d to 3s 6d. In March 6s 3d to 6s 3½d was paid for fine, and 5s 5d clean scrap. In June, fine sheet and biscuit declined to 5s 9d to 5s 9½d, pressed block scrap 3s 6d to 4s; and subsequently values fell to our closing sales of fine at 5s 5d to 5s 7½d, but the washed crepe much higher, good pale 5s 6d to 5s 8d, brown and dark 4s 9d. Prices fluctuated this year with Amazon (Para) rubber.

The world's supply of rubber in 1906 we estimate nearly 65,000 tons, and consumption almost as much. Planting has greatly increased and will produce much more in the near future. We estimate planted and planting, (but some mixed with tea and cocoa and coffee).

Ceylon	100,000	acres
Malaya, Malacca, Sumatra, &c.	90,000	,,
Borneo	12,000	,,
Java	20,000	,,

Mexico has some large plantations, also Nicargua and Honduras, and some in Colombia, Ecuador, Bolivia and Peru. India has begun, say 10 to 20,000 acres planting, Burmah and Mergui begining: the Phillipines, Samoa, Hawaii and other Pacific Isles, and Seychelles and West Coast Africa will add to the supply; also the West Indies. In the Congo and German West Africa plantations are in progress. We repeat our caution to plant, where practicable, *Hevea Braziliensis* as hard clean rubber sells best. The supply from the Amazonas (Brazil) shows no sign of reduction; Brazil exported 38,000 tons. Stimlus is given to the production of other rubbers in Brazil, such as Manicoba, etc., by various companies working with large capital, and supplies this year have considerably increased. Large quantities of Guayule from Mexico have been disposed of in America and Europe. English manufacturers have as yet scarcely used it, not being attracted by it, but are making further experiments. There has been a sustained demand throughout the year, and manufacturers have been busy. Motor vehicles of all descriptions have largely increased tyre makers' demands.

The world's supply of nearly 65,000 tons has probably nearly all gone into consumption. But the bull movement of the first four months was not successful. We close with a decline for the 12 months on fine grades of Para, Bolivian and Peru of 2d per lb., but a penny advance on scrappy negrohead owing to scarcity, and on Caucho ball (which has been in great demand for "tyres" and has been "oversold" the last few months) a rise of 5d per lb., following the advance of 6d in 1905. The supply of mediums has rather increased, but not from West Coast Africa, which totals about 17,200 tons, against 17,500 tons in 1905.

Visible Supply 1st January, 1907. See below for complete Statistics.

		1907.	1906.	1905.	1904.	1903.
Of Para and Peruvian ...	tons	2,162	2,874	2,666	3,262	3,365
Including America	,,	1,160	1,600	1,830	1,430	1,365
Brazil and Bolivia (from the Amazonas)		tons	34,520	34,420	30,385	31,070
Including Peruvian and Caucho *via* Iquitos and Manaos		,,	6,250	6,100	4,390	4,050

The fine has been generally well selected and *should be cut and carefully sorted before shipment*. The Caucho ball has been good and slab fair. Bolivia has sent larger supplies, but of Mollendo rather less. Venezuela *via* the Orinoco increased and sold high. Ceara and Manicoba increased and sold cheaper, especially poor quality of the latter (Plantation down to 4s 1d). Of Pernambuco and Assare small lots sold well. Mangabeira increased and of nicer quality. Mattogrosso prices declined for virgin about 3d. Central America and Mexico supplies do not increase and prices of good Colombian, Ecudaor, Nicaragua, show an advance of 4d per lb. (in sympathy with the rise of Caucho ball from the Amazonas). Plantation lots from the Cauca, Carthagena, and Tumaco have brought good prices; much above any previous year.

	1906.	1905.	1904.	1903.
West Coast African ... (total)	17,200 tons	17,500 tons	18,000 tons	15,000 tons
including Benguela and Mossamedes	1,450 ,,	1,650 ,,	1,600 ,,	1,450 ,,
Loanda	700 ,,	800 ,,	950 ,,	980 ,,
Congo, French Congo and Soudan 3% (dearer)	5,900 ,,	5,650 ,,	5,800 ,,	5,600 ,,

The quality has been good, and nice qualities have brought higher prices. Niger, Gold Coast, Accra, Lagos, etc., sold readily. Cameroons, Sierra Leone, Gaboon and Conakry in great demand and higher. French Congo and Soudan mostly from Senegal via Bordeaux sold well, and quality liked. 1,300 tons in 1906, 1,250 tons in 1905, and 1,200 tons in 1904. Liverpool imports W.C.A. 4,770 tons in 1906, against 4,700 tons in 1905, and 5,080 tons in 1904.

EAST COAST AFRICAN.—Zanzibar. &c., increased and prices are again 2d higher; also Nyassaland and Mombassa more. Lamu again higher. Uganda of nice dry quality sold well—pears 4s. Plantation sheet 4s 11d to 5s. Madagascar sent greatly increased quantities, and fine cured clean biscuits, &c., realized very high prices, soft and common no dearer. Niggers have been poor quality and sold slowly and cheap—a few nice lots realized high prices, 2s to 2s 3d. Rangoon—moderate supplies sold higher. Assam—prices close 2d lower. Penang decreased, and has sold without much change throughout the year. Mixed lots very difficult to sell. Java sent odd small parcels, but is begining "to plant" largely. We had more Borneo which sold dearer; also Tonkin and French Cochin China good quality in good condition up to 4s 1d. Scarcely any from New Guinea. Pontianak sold largely at about previous years value.

Balata was in much reduced supply, consequently the price gradually advanced, fine sheet closing 2s 2½d to 2s 3d, block 1s 8d to 1s 8½d.

Gutta Percha still slow of sale at moderate prices for all but the finer qualities, which are scarce. Most of the business done has been in reboiled at about 5d.

REVIEW OF PARA PRICES FOR 1906.

The year opened with a quiet market, and sales of fine hard at 5s 4½d, soft 5s 4d, negrohead scrappy 4s, Cameta 3s 3d, Island 3s 3d, Caucho ball spot 3s 10d. With few sellers and a powerful bull movement here and in America, hard fine advanced by March to 5s 6d, and soft 5s 4d; ball was then 3s 8½d to 3s 9d, scrappy 3s 11d. Cameta 3s 2¾d. Island 3s 1½d. The market became dull. and declined till July, which was about the lowest of the year—fine hard to 5s 1d soft 5s 0¼. Cameta negrohead 3s 0¼d. Island 2s 9d. Prices rallie a little during the succeeding months and in October hard fine was 5s 3d s [illegible] 1¾d, scrappy 4s 1½d, ball 4s 1½d. Cameta 3s 0½d, Island negrohead 3s. In November hard fine declined to 5s 1½d and soft to 4s 11¾d (the lowest point of the year), but ball was dearer at 4s 3d, and negroheads steady. Closing prices of fine hard 5s 2½d. Soft 5s 0½d, scrappy negrohead 4s 0¾d, Cameta 3s 1½d, Island 3s; Caucho ball, spot 4s 3d, February-March 4s. There was but little speculation throughout the year.

INDIA RUBBER STATISTICS FOR 1906.

Total Imports &c., of all sorts were:—

	ENGLAND. Imports.	Deliveries.	Stock. 31st Dec.		LONDON. Imports.	Deliveries.	Stock. 31st Dec.
1906 ...	21,269	21,162	1,669 tons	1906 ...	2,604	2,444	691 tons
1905 ...	21,700	21,410	1,562 ,,	1905 ...	2,126	2,003	531 ,,
1904 ...	19,883	20,035	1,272 ,,	1904 ...	1,932	1,770	408 ,,
1903 ...	19,464	19,626	1,424 ,,	1903 ...	1,289	1,273	246 ,,
1902 ...	16,932	18,113	1,586 ,,	1902 ...	826	1,185	230 ,,

	Imports. Para, Manaos.	Imports. Peru, Caucho.	Deliveries. Para, Manaos.	Deliveries. Peru, Caucho.	Stocks, 31st Dec. Para, Manaos.	Stocks, 31st Dec. Peru, Caucho.		Prices, 31st December. Fine Para.	Negro-head Scrapy.	Negro-head Island.	Cauc Ball.
1906...	8728	3435	8924	3471	377	25	1906...	5/2½	4/0¾	3/	4/3
1905...	10156	3328	9760	3336	573	61	1905...	5/5	4/	3/3½	3/10¼
1904...	8568	2584	8938	2545	177	69	1904...	5/1	3/10	2/8½	3/4
1903...	10630	2216	10978	2230	547	30	1903...	3/11	3/3½	2/4	3/3½
1902...	10296	1442	10700	1572	895	44	1902...	3/9	3/0½	2/6	3/1

	1906.	1905.	1904.	1903.	1902.
Imports of other Rubber besides Para and Peruvian to England.	9,106	8,216	8,731	6,618	5,194
Deliveries do do do ...	8,767	8,314	8,552	6,418	5,841
Stock 31st December do do do ...	1,267	928	1,026	847	647

1906.	Rangoon Assam, &c.	Penang.	Borneo.	Zanzibar and Mozambique.	Madagascar.	Manicoba, Ceara, P'nam Assare &c.	Mattogrosso.	W. C. African.	Mollendo.	Plantation Ceylon & Malay.
Imports ...	288	345	261	147	346	1540	172	4880	204	461
Deliveries ...	221	484	267	127	235	1338	192	4877	209	411
Stock 31st Dec	122	142	57	29	136	370	10	317	4	71
Imports 1905	271	629	251	69	113	1662	226	4789	183	70 75
do 1904	164	599	121	197	159	1913	191	5144	244	

INDIA RUBBER MARKET.

London, January 4th.—At to-day's auction, 357 packages of Ceylon and Malaya plantation grown rubber were under offer, of which about 292 were sold. The total weight amounted to over 21 tons, Ceylon contributing over 8¾. and Malaya over 12⅓. This was the first sale held since 18th December. The market opened with good demand for all descriptions, fine pale crepe again being keenly competed for and fetching the highest price, viz., 5s. 9½d. per lb. For fine biscuits and sheet, prices generally paid were in the neighbourhood of 5s. 7d. A large parcel of fine Malaya block rubber from Lanadron Estate weighing over 2 tons was offered, but withdrawn for private treaty. A fine lot of Rambong crepe realised 5s. 0¼d. Plantation fine to-day.—5s. 7d. to 5s. 9½d., same period last year, 6s. to 6s. 2d. Plantation scrap.—4s. 4d. to 4s. 5½d., same period last year, 3s. 6d. to 5s. 4d. Fine hard Para (South American).—5s. 2½d., same period last year, 5s. 4¼d. Average price of Ceylon and Straits Settlements plantation rubber 292 packages at 5s. 3½d per lb., against 300 packages at 5s. 3¼d. per lb. at last auction. particulars and prices as follows:—

CEYLON.

MARK.	QUANTITY, DESCRIPTION AND PRICE PER LB.
O.B.E.C. (in diamond)	3 cases good darkish sheet, 5s 6½d ; 1 case fine pale ditto, 5s 6¾d ; 1 case pressed scrappy sheet, 4s 5¼d.
Arapolakande	8 do good dark biscuits, 5s 6¾d ; 2 cases darkish pressed scrap, 4s 4d.
Culloden	8 do good large pale biscuits, 5s 7d¼ ; 3 cases fine very pale pressed crepe, 5s 9¼d ; 7 cases good darkish crepe, 5s 2¾d ; 4 cases dark pressed crepe, 4s 9¼d.
Ellakande	1 do dull palish biscuits, 4s 7¼d ; 1 case darkish pressed crepe, 5s 2d ; 1 case black pressed crepe, 4s 6d.
Heatherley	4 do fine pale biscuits, 5s 7¼d ; 4 cases fine palish pressed crepe 5s 3¼d.
Nikakotua	1 do good large palish biscuits, 5s 6½d.
Ingoya	1 do fine blocked biscuits, 5s 6¾d.
Nikakotua	3 do good palish and darkish sheet, 5s 6¾d,
G.U.L.A. (in diamond)	4 do good palish and darkish sheet, 5s 7d ; 2 cases rejections, 4s 5¼d.
Kumbukkan	1 do palish biscuits, 5s. 7d.
Duckwari	1 bag thick pressed rejections, 3s 11d ; 1 case pressed scrap, 4s 1d.
C.L. (in diamond)	15 do good darkish crepe, 4s 11¾d ; 3 cases darkish crepe, 5s ; 2 cases cuttings, 4s 7d ; 1 case pressed scrap, 4s 5½d ; 1 case superior, 4s 2¾d ; 1 case crap, 4s 4¾d.
Kipitagalla	1 do cuttings, 4s 5½d.

Tallagalla	2 do	good dark biscuits, 5s 7d; 2 cases dark pressed scrap, 4s 5¼d.
Sunnycroft	1 do	fine pale biscuits, 5s 7d.
Gonakelle	1 do	fine palish to darkish biscuits, 5s 7¼d; 1 case good pressed scrap, 4s 5¼d; 1 case pieces, 4s 5d.
Balakadua	5 do	fine pale biscuits, 5s 7¼d; 3 cases good darkish pressed crepe, 4s 11¾d.
Imboolpitiya	1 do	biscuits and sheet, 5s 6d; 1 bag scrap, 4s 4¾d.
Waharaka	2 do	good darkish biscuits, 5s 7¼d; 2 cases inferior scrap, 4s 4½d.
Ayr		1 box fine large biscuits, 5s 7¼d.
Doranakande	3 do	good large dark biscuits, 5s 7¼d; 3 cases palish scrap, 4s 5½d; 1 case pieces, 4s 5d.
Taldua	3 do	palish to darkish biscuits, 5s 7d¼.
Ambatenne	1 do	fine palish to darkish biscuits, 5s 7d; 1 case darker, 5s 7d.
Glanrhos	9 do	good palish to darkish biscuits, 5s 6¾d; 1 case darkish and dark crepe, 5s 0½d; 5 cases darkish crepe, 5s; 2 cases good darkish sheet, 5s 6d; 1 case similar, 5s 6¼d.

STRAITS SETTLEMENTS.

MARK.	QUANTITY, DESCRIPTION AND PRICE PER LB.	
P.S.E.	9 do	good palish sheet, 5s 6¾d; 5 cases darkish crepe, 4s 10¾d.
S. (in diamond) S.R.	1 do	pressed scrap, 4s 5¾d.
P.R.S.B.	8 do	good large palish sheet, 5s 6¾d; 8 cases scrap, 4s 5d; 3 cases rejections, 4s 6d to 4s 6¾d.
E.B. & Co. (in triangle)	11 boxes	fine palish sheet, 5s 7d; 1 box darker, 5s 6¾d; 1 box scrap, 4s 3d; 1 box rejections, 3s 11d; 2 boxes cut sheet, 5s 5¼d; 1 bag scrap and rejections, 4s.
Batu Unjor Estate	8 cases	fine palish scored sheet, 5s 7¼d; 2 cases darker, 5s 7d; 2 cases palish to darkish crepe, 5s 4¼d; 1 case darkish crepe, 5s 1½d; 3 cases good darkish crepe, 5s 3d.
Shelford	1 do	good darkish sheet, 5s 4d; 2 cases darkish crepe, 5s 0¼d; 1 case reddish crepe, 4s 9¾d; 1 case good darkish crepe, 4s 10½d.
F. (S.) R. Co. Ltd.	3 do	fine palish to darkish sheet, 5s 6¾d; 2 cases good greyish, 5s 0½d; 1 bag pale sheet, 5s 6d; 1 case dark block, 4s 1d.
P.	2 do	fine pale crepe, 5s 8¾d; 3 cases palish scrap crepe, 5s 4¼d; 4 cases darker, 5s. 0¼d.
R.	2 do	fine Rambong crepe, 5s 0¼d; 2 cases darker, 5s. 0¼d. 1 case red crepe, 4s 6¼d.
P. & R.	1 do	block crepe, 4s 6¼d.
L. E. (Muar in triangle) Straits	1 do	fine pale crepe, 5s 9½d; 10 cases dark crepe, 5s 0½d.
G.B. (in diamond) K.K.	2 do	fine pale sheet, 5s 7¼d to 5s 7½d; 1 case good ball scrap, sheet, etc., 4s 5¼d.
B.S. Bila	5 do	fine large darkish sheet, 5s. 7½d; 2 cases paler, 5s 7½d; 4 cases scrap, 4s 5½d; 1 case darker, 4s. 5¼d.
S.P. (in circle)	1 do	good palish sheet, 5s 7½d; 2 cases good palish sheet and biscuits, 5s 7½d; 3 cases somewhat similar, 5s 7¾d; 3 cases good pale sheet, 5s 7½d.
Guthrie & Co., Ltd.	23 do	fine cases pale crepe, 5s 8½d to 5s 8¾d; 3 cases darker, 5s 7d.
Sungei Krudda	1 do	palish scrap, 4s 5½d; 4 cases darkish, 4s 4¾d.

OILS AND FATS.

CAMPHOR OIL.

The scarcity of this oil has increased in a marked degree since we published our last Report, so that it is necessary to regard its future with serious apprehension. The deliveries of red Camphor oil in Formosa are said to have been so unimportant in the last few months, that the demands of the Direction of the Monopoly could hardly be satisfied,—much less even a moderate quantity becomes available for export. For white oil the demand was so brisk from the Japanese industry (which in the course of time has also been able to make use of this article for their purposes), that the export of any quantities worth mentioning was out of the question. Whatever quantity of these two sorts was shipped to Europe and the United States in the course of the last few months, originates therefore from unexpired contracts. The value of the camphor oil shipped from Japan in the first six months of this year amounted only to 71,102 yen, in spite of the much higher prices, against 131,007 yen in the same period of last year.

The following summary which has been taken from the Reports of the British Foreign Office (Ann. Series. No 3675) gives further information on the export of camphor to the individual principal consuming countries in the last three years. The value of the total shipments has fallen off in that time by nearly £100.000, in spite of the higher market.

	India.	France.	Germany.	U. States.	U. Kingdom.	Total.
	£	£	£	£	£	£
1905 ...	53,000	58,000	12,000	100,000	26,000	262,000
1904 ...	82,000	71,000	15,000	128.000	8,000	323,000
1903 ...	61,000	37,000	68,000	117,000	50,000	361,154

The deficiency in the Formosa production appears to be chiefly due to the indiscriminate cutting-down of the trees which has taken place there during the last few years, and which must have caused considerable damage to the camphor-forests. This seems to be borne out by a proclamation issued in June of this year by the Governor General of Formosa, General Sakuma, in which the peasants were strongly urged to devote their attention more to the production, and to improve and extend as much as possible by new cultivation the plantations which had greatly suffered from the system of irrational exploitation hitherto in vogue. The proclamation also mentions that new cultivations covering an area of 1,500 ko (1 ko = about 2½ acres) have been commenced, and that it was intended to extend these, provided the Government received the necessary support from the peasants. How much time will elapse before these new forests are productive, and whether the call on the peasants will meet at all with a sympathetic response, it is of course at present impossible to say.

The following translation of an article which appeared in the "Taiwan Nichi Nichi Shimpo" (Formosa Daily News) of the 1st of February and was forwarded by the British Consul at Tamsui, may be of interest to persons dealing in camphor.

The previous prices, which have now been increased, were as follows (per picul = 133⅓ lb.) :—

District.	Crystalised camphor.			Camphor oil.
	1st grade.	2nd grade.	3rd grade.	
	Yen.	Yen.	Yen.	Yen
Gilan, Shinko, Toyen, Shinchiku, Bioritsu, Taichu, Nanto, Toroku	30,00	27,00	24,30	15,00
Kagi	31,00	28,00	25,30	15,50
Taito	32,70	29,70	27,00	16,30

There was great shortage in the production last year, and as the more easily accessible trees have nearly all been cut down, and the head-hunters still continue to make attacks on unprotected workers who advance too far into the camphor-forests, the Monopoly Bureau thought it advisable to stimulate producers and give them better protection against the savages.

The Monopoly Bureau and their selling agents, Messrs, Samuel, Samuel & Co., have not disclosed whether any difference has been made in the price at which the camphor is handed over to them. The camphor oil is all sent to the refineries in Japan, where about 49% of camphor if extracted from it. A sketch-map accompanied this despatch, showing the Formosa districts mentioned herein.

Hitherto, with the exception of what comes from distant places, like Taito and Kagi, the Government have bought camphor and camphor oil at the same price although from different places, with the result that producers have gained or lost according to the circumstances and locality of production and in some districts the camphor worker has obtained practically no profits at all.

The Government, therefore, have now taken this matter into consideration and have decided to alter the purchase-price in accordance with the conditions prevailing in each one of the various producing districts throughout the Island; this has resulted in an increase all round on previous prices, and the following table shows the increase in the present compared with the former prices for camphor and camphor oil.

DELIVERED AT TAIHOKU PER PICUL (133 1/3 LBS).

Camphor same for 1st, 2nd and 3rd grades.			Camphor oil.	
Gilan increase of yen	(2/0 ½)	3,40	Increase of yen	1,60
Shinko (1 part) ,, ...	...	0,90	,, ,, ...	0,20
,, other part ,, ...	...	2,70	,, ,, ...	1,10
Toyen (1 part) ,, ...	...	0,50	No alteration	
,, other part ,, ...	...	3,10	Increase of yen	1,20
Shin-chiku ... ,, ...	...	6,60	,, ,, ...	3,10
Byoritsu ... ,, ...	...	2,30	,, ,, ...	0,90
Taichu (1 part) ,, ...	...	3,10	,, ,, ...	1,20
,, other part ,, ...	...	1,60	,, ,, ...	0,60
Nauto ... ,, ...	...	1,60	,, ,, ...	0,60
Toroku (1 part) ,, ...	...	1,20	,, ,, ...	0,30
,, other part ,, ...	...	1,50	,, ,, ...	0,50
Kagi ... ,, ...	...	4,50	,, ,, ...	2,00
Taito ... ,, ...	...	1,20	,, ,, ...	0,40

The largest increase amongst the above is that for Shinchiku, which shows camphor (yen) 6,60 and camphor oil (yen) 3,10, the difference in the increase for districts varies in accordance with the richness of the material, the cost of transport, the accessibility of the camphor forests, the cost of labour and the cost of living, etc. so as to allow of fair profits being obtained even in districts where very small quantities are produced. This result had previously not been obtained and it is therefore expected that even abandoned camphor districts will now once more be worked upon and that the total camphor production will be increased and the trees be handled more carefully. Furthermore, as a natural consequence of the increase in the purchasing price, the Monopoly Bureau will alter the selling price at which it hands over the camphor to Messers. Samuel, Samuel & Co., the selling agents, and from the 10th instant the price will be increased, so that the price at which Messrs, Samuel, & Co. sell abroad will also necessarily become higher, but it is expected that an increase in Samuel, Samuel & Co's. selling price will have very much effect on the market. The reason for this is that hitherto the selling agents

have sold what they have bought from the Bureau within the fixed limits, taking a certain percentage as commission, and that whereas the World's demand for camphor is nine or ten million pounds, the supply from Japan and Formosa is only 6 or 7 million pounds, so that as soon as the camphor leaves the selling agents' hands, it jumps up in price, and the difference between the market and Messers. Samuel, Samuel's selling price is very great. Any way the increase in the Government's buying and selling prices will probably result in large profits for the camphor industry."

With regard to the camphor producing districts of other countries, it is to be regretted that for the present no relief of the existing scarcity can be expected from that side. A report from the U. S. Consul in Amoy says that the camphor monopoly granted in 1903 to a Japanese Company for the Chinese province Fokien has been cancelled by the Government, after payment of a not inconsiderable indemnity, but that the Japanese even under the new conditions still control the production, and, as our own informants tell us, pay any price in order to secure every consignment.

THE INDUSTRY IN CEYLON.

The camphor production in Ceylon is unfortunately still in a very bad way, and although much attention has now for several years been given to this new cultivation, it has not yet been possible to produce actually more than about 1,000 kilos. If it is taken into consideration that more than 100 acres are planted with camphor-trees, the result must be called unsatisfactory. The principal difficulty lies in the lack of experience of the planters in the distillation, and it is believed that the Japanese and Chinese make use of special technical artifices to secure a paying yield. It is said that the plantations will be extended further and it is hoped that the energy of Mr. Kelway Bamber, the Government chemist at Peradeniya, will succeed in overcoming the existing difficulties, and showing the planters a remunerative method of manufacture. The present high prices of camphor are naturally very tempting, and it remains an open question whether the cultivation can still pay, if some day the camphor market returns to a normal level.

According to a report from the German Consul at Bombay, the Government, on the suggestion of the local Chamber of Commerce, has the intention of making experiments in the planting of camphor-trees in the Bombay district, and we hope on a later occasion to be able to return to the results of these experiments. The climatic conditions on the Indian coast agree approximately with those of Formosa, and in our opinion the prospects are therefore favourable.

M. Kimberlin reports in the "American Druggist and Pharmaceutical Record" (according to an article in the "Tropenpflanzer") on experiments in the cultivation of camphor-trees in California :—

Camphor-trees have been found near Lake Shabot in the mountains situated sideways of Berkeley in Almeda county, Cal. ; most of these trees are 20 to 35 years old, as can be ascertained from the annual rings. They belong to the species *Cinamom camphora*, from which the official camphor is obtained. They are over 25 feet high ; the trees have a large number of branches, a smooth bark, and green, broad, thick leaves pointed at both ends. The freshly peeled bark has an odour like sassafras. The trees grow in a heavy soil, have tapering trunks, with numerous roots which supply abundant nourishment to the tree. When the leaves are rubbed they emit a camphoraceous odour, which is also apparent in all the other parts of the tree. The wood leaves and branches burn very readily, owing to their camphor-content. The camphor contained in them belongs to the class of general camphors ($C_{10}H_{16}O$) and is reckoned among the ketones.

Experiments made with the wood of these Californian camphor-trees, when it was distilled with a little water, on condensation of the vapours, actually resulted in a yield of camphor. The leaves contained about 0·15% camphor of great purity, purer than Japanese or Chinese camphor which must first be purified by refining. The camphor obtained by heating the wood of the Californian camphor-trees to a higher temperature, was not so pure as the product distilled from the leaves and branches.

Camphor-trees were planted by the Department of Agriculture in many places, and have grown up to fine, tall, green trees; they are more weather-resisting than orange trees, for which they served to afford shade. Camphor-trees thrive in the climate of the coast, to the North of Charleston, in South Carolina, and along the Californian coast. It will be left to a later age to derive profit from the camphor-trees planted, as considerable quantities (annually about 6000) are planted out from the nurseries in suitable districts; but further experiments must show whether the leaves, branches, roots, or the wood of the trunk yield the best camphor, and what will be the best camphor, and what will be the most suitable season, the best method of distillation, etc.

On the occasion of the 6th International Congress for Applied Chemistry at Rome, Giglioli pointed out, in a paper on Italian camphor, that the camphor-tree thrives in almost every district of Italy, except in the neighbourhood of the Alps, and that it would therefore appear desirable to promote the cultivation of this tree in Italy, the more so as it does not make a large demand on the soil. According to experiments made the leaves of the tree are said to yield on the average about 1% camphor, whilst the wood, which moreover lends itself exceptionally well for the manufacture of furniture, contains about 0·1% camphor of inferior quality.

We have on several occasions, when discussing the camphor industry in our Reports, also referred in a more or less detailed manner to the cultivation of the camphor-tree*), and for this reason we wish to call attention to a most interesting article which deals with the observations made by C. Crevost†) with regard to the cultivation of the camphor-tree in Indo-China. In Tonquin, Kwang-Tcheou-Wan, and especially in Annam the cultivation of the camphor-tree justifies the most sanguine expectations. Various samples distilled by Aufray, the Director of the Tonquin laboratory, gave the following results as compared with Japan camphor (camphor oil+camphor);—

	Japan.	Tonquin.	Kwang Tcheou-Wan.
Ordinary branches ...	3.70 per cent. ...	3.90 per cent. ...	3.25 per cent
Lower portion of trunk...	4,23 do ...	2.70 do ...	3.55 do
Roots...	4.46 do ...	4.60 do ...	3.55 do

Contrary to the camphor-trees in Japan and in Kwang Tcheou-Wan, those in Tonquin always give a larger yield from the branches and roots than from the trunk. The yield mentioned in the table is, however, exceptionally very small, as the sample was taken from a hollow tree of very medium quality. The information given by Crevost dates already from the spring of 1904, and it may therefore be assumed that the experiments have since been extended. The solution of this question is too important to be neglected, and we hope to be able to return to the subject in our next Report.

From the Imperial Biologico-Agricultural Exprimental Station Amani in German East Africa, we recently received a camphor oil which had been obtained in a yield of not quite 1% by distillation of the leaves and branches of camphor-trees,

*Reports October 1901, 13; October 1904, 15; April 1906, 11.
†Journal d'Agriculture Tropicale 6 (1906), 105.

respectively 2¼ and 1¼ years old. The oil sent to us was a filtrate of the original oil which separated off camphor spontaneously, and had the following properties: d_{15} 0·9236; a_D +39° 20; soluble in 0·25 vol. 90 per cent. and in 10 vol. 80 per cent. alcohol. The colour was golden yellow, and the odour differed considerably from that of ordinary camphor oil. When cooled, the oil congealed into a solid mass. By means of 4% soda liquor, traces of a phenol were obtained which had an odour like carvacrol, but could not be identified further. Eugenol which, as is well known, is present in the ordinary camphor oil usually obtained from the wood of the roots and the trunk, could not be detected. Neither did the oil contain alcohol (borneol) in any appreciable quantity; we found the acetylation number 14·5. the camphor-content of the oil as received by us was 75%. It also differed from Japan oil by the absence of safrol. We attempted to detect this constituent by treating the oil several times with hydroxylamine in order to remove the camphor, and fractionating *in vacuo* the unchanged portion of the oil which had distilled over with the water vapour. But not one of the fractions boiling between 50° and 110° (7 to 8 mm. pressure) had even a remote odour of safrol. This difference in the composition of the two camphor oils in question may be due to this, that in the distillation of the oils the parts of the plant used were not the same.—*Report of Schimmel & Co.*, Nov. 1906.

CITRONELLA OIL.

The position of this important article can be judged only with difficulty, as reports on the conditions in the producing districts have lately been very scarce, and one has chiefly to depend on conjectures. It may be taken as a fact that all the oil shipped before the bursting of the monsoon, i. e. in October and November, will be absorbed by existing contracts; the unimportant quantities which arrive during the monsoon are too small to have any effect whatever on the market, and as the production in December and January is generally much smaller than the result of the July-September harvest, it is probable that speculative sales made in the meantime will not allow the market to become quiet.

The figures of the export from Ceylon up to 20th August are:—

in 1906, 694,267 lbs. against {in 1905, 855,615 lbs.
in 1904, 768,660 "}

The shortage of about 160,000 lbs. as compared with 1905 may therefore be the principal cause of the present firm state of the market, for the demand of the soap-industry is decidedly increasing, the more so as spike and lavender oils have long since become too expensive for cheap soap. If, therefore, the shortage in the export increases towards the end of the year, there can be no doubt that in 1907 the prices will be considerably higher still.

We have at our disposal stocks of considerable quatities, propotionate to our sales of this article, and would ask buyers of large quantities to apply our special quotations when in the market. We were recently compelled to raise the price of the Java quality which is in great request, especially from the side of the manufacturers of better-class soaps, as the producer under the existing condition appeared not to make any profit out of it. The shipments during the last few months were also far from plentiful, and we are anxiously looking forward to the receipt of further new explaining the causes of this regretable shortage.

According to a paper by Wright endeavours are made to render the citronella industry more remunerative by using the grass from which the oil has been removed as raw material for the manufacture of paper, for which purpose it is said to be very suitable.

We need not enter more fully into the further details given by Wright on valuation and judging of citronella oil, as these appear to be chiefly based upon the work of Sage, with which we have already dealt in our last Report. We also consider that the content of geraniol represents the principal factor in judging the value of citronella oil; but Schimmel's test, carried out by itself, will, according to our experience, always give useful data for a rapid test of the quality of a citronella oil. *Report of Schimmel & Co.* November 1906.

LEMONGRASS OIL.

As already predicted in our April Report, a reaction has at last come in the price of this article, and the market has dropped from 8½d. per oz. in April to 3d. per oz. It is to be hoped that the remunerative prices of last year have not induced the planters to extend their plantations too much, for in such case they would undoubtedly suffer a very severe disappointment. Although the oil of *Backhousia citriodora*, with an aldehyde-content of about 98%, consisting chiefly of citral, has not yet been shipped in large parcels, it can (as we hear from an absolutely reliable source) be supplied in such quantities, and in spite of the high wages in Australia, in case of need at such a low price, that lemon grass oil, even at a price of 3d. to 4d. per oz., can no longer come under consideration for the manufacture of citral. We think it well, however, to point out to the Australian optimists that the citral manufacture is by no means exclusively dependent upon lemongrass oil and Backhousia oil, but that other cheap raw material has also to be taken into account.

The shipments from Cochin during last season, i. e. from 1st July 1905 to 30th June 1906, amounted to :—

190½	cases	to	London
100	,,	,,	Havre
200	,,	,,	Marseilles
218 1/3	,,	,,	Hamburg
330½	,,	,,	New York
1230 1/12	,,	,,	Asiatic ports (Bombay and possibly subsequently Europe)

Total 2269 5/12 cases.

For the sake of comparison, we quote here again the shipments of the last few years :—

1904-1905	1881½	cases
1903-1904	2222½	,,
1902-1903	2806	,,

Through the kindness of Mr. P. Bussy we received a sample of lemongrass oil which had been distilled in the Government laboratory at Saigon (Cochin China). It had the following properties: d_{15° 0,8917; a_D -0° 10; aldehyde-content about 82%; insoluable in 10 vol. 70 per cent. alcohol; soluble in 0,9 vol. 80 per cent. alcohol, when more solvent is added soon strong turbidity; with 90 per cent. alcohol it forms at first a clear solution, but when more than 1,5 vol. are added, cloudiness occurs. According to these results the oil behaves like the West-Indian and African lemongrass oils, which we have repeatedly referred to in our Reports*). Owing to the deficient solubility, the oil has a lower commercial value than tha ordinary East Indian lemongrass oil.—*Report of Schimmel & Co.* November 1906.

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*) Comp. Report April 1906, 44: also October 1902 50 : April 1903, 23, 49 ; October 1903, 46 ; October 904, 53 ; April 1904, 84.

FIBRES.

CARAVONICA COTTON.

Many references have been made in agricultural and other papers to the remarkable qualities claimed for the Caravonica cotton. The following statement in regard to it was made in the Annual Report of the Queensland Acclimatization Society for the year ended March 31st, 1905:—

During last year considerable attention has been attracted to certain varieties of cotton in the Cairns district, and named Caravonica. The society has received seed and lint of this cotton, one considerable parcel having been handed direct to the writer by Sir Herbert Chermside, in the original package as sent to him by Mr. Thomatis, who has enthusiatically taken up the question of this supposed new variety. Most careful comparision has been made in various ways with this variety with rather disappointing results. In appearance, little, if any, difference can be perceived between it and other cottons well known in the States. The overseer has grown it alongside the plants which it resembles, and can discover no variation. A rather poor yield of this variety may be a circumstance that would disappear with the planting of seed from plants grown under local conditions.

The overseer has examined the Caravonica variety as grown in the North, and neither he nor Mr. Jones, who has also been comparing this variety with other well-known sorts, can detect any superiority. To all intents it is one of the Egyptian type.—*Agricultural News* (*West Indies.*) Nov. 1906.

EDIBLE PRODUCTS.

Dry Grains in Ceylon. IV.

BY J. F. JOWITT.

Zea Mays L. Muttu Cholam. T. Muttu=Pearl, Cholam see below. *Bada Irungu S.* Bada=belly, alluding to the "Cob" being enclosed in spathaceous leaves—Irungu=Wheat.

Classed by natives with *Andropogon Sorghum*, owing to the general growth of the two species being similar, though the inflorescence is very different—Mr. Herbert Wright has written fully about this species in Vol. III No. 5 Circular and Agricultural Journal of the R. B. G., Ceylon.

Andropogon Sorghum, Brot., Sorghum Vulgare, Pers., Holcus Sorghum, Linn., Arisi Cholam. T. Karal Irungu S. Kaka or Karum Cholam, T. Kalu Irungu S. Shada, T. are all varieties of one and the same species *A Sorghum, Brot.* known also as the Indian or Great Millet; Guinea Corn; Turkish Millet; Sorgho; Imphee; Kaffir Corn; Congo Millet; Jerusalem Corn; Broom; Milo Maize; etc., it is the *Juar* of India, and each variety has a special vernacular name.

Sir George Watt, on the authority of Sir Walter Elliot whom he characterises as a "botanist and linguist of no mean order" says, "the Tamil for the plant, *Cholam* was in all probability derived from the fact that it was the chief grain of the *Chola* country," mentioned by Mr. P. Arunachalam in Sketches of Ceylon History as being in South India.

Arisi=rice; though "arisi is a generic Tamil word applied to the cleaned grain of any cereal when ready for consumption." *It appears to be used in Ceylon as the specific name of a variety with very loose, nodding panicles.

Irungu seems to have been a name of purely Tamil use in early times. "It is now used in a restricted sense for a particular group of varieties which are characterised by a very lax inflorescence, and by the grain being almost entirely covered by the closely adhering glumes."* I am told that Irungu signifies wheat Karal=panicle or spike of grass Kaka, T.=crow-like, referring to the colour of the grain, Karum, T. Kalu, S.=Black. Shada, T. this name was given me by one of my coolies as the name of a variety with a very compact head, which I have since identified as Sen (red) Cholam, from Salem.

Shada literally is applied to the matted locks on the head of a cooly who is under a vow and has dedicated his hair to some god; it is an instance of the same variety being known by natives under different names. Very little reliance can be placed on the native names for grasses, is my experience, the same name being applied to different species in different localities.

Andropogon Sorghum Brot. is accepted by most botanists as a cultivated form of *A Halepensis Brot.* which I have myself collected in a wild state in Uva.

In connection with this wild form, Mr. I. H. Burkill (Reporter on Economic Products in India), wrote in 1902. "Its flowers are arranged in a very loose inflorescence and the little grains are soon lost at ripeness, by the breaking of the flower stalk below them. To cultivate and select till the stalk became firm, to make the grains larger and larger, and to mass them into a solid head, have been the objects of generations of cultivators and have been attained:—in the case of the first object, so that no cultivated *juars* drop their seed by the breaking of the flower stalk; in the case of the second, so that the largest grains seen from India are ¼ inch long and 3/16 inch broad; and in the case of the third object so that the best varieties carry the flowers densely packed, and produce a club-shaped head of seed,

We find the chief stages of the evolutionary process represented in the great variety of cultivated forms. There are forms with a light feathery inflorescence very like the wild *baru* (*Andropogon Halepensis*) except that the grain is larger and the flower stalk does not break at maturity, and from these forms we get a progressive series in which the grain grows longer until it overtops the chaff, and the flower stalk grows shorter until the flowers are aggregated—it is claimed for the more primitive forms of *juar* that birds cannot perch on the heads and peck off the grains; and therefore the people who cultivate little patches in the forest find them more profitable."†

This was not the experience of a cangany cf mine who had a small patch of *arisi cholam* in is garden, the birds and rats got all the grain although he had strings and rags put up to scare them away.

When it is considered that in the Bombay Presidency alone over 250 races of the plant are recongnised†, (in the Bengal Presidency it does not seem to be cultivated to any extent) and that 63 named varieties are given for Madras*, the difficulty of classifying the varieties of Sorghum will be admitted.

In 1902 Mr. I. H. Burkill made a tentative classfication and arranged the Sorghums in 8 groups and 22 varieties with sub-varieties, this classification is from a botanical point of view.

Taking Mr. Burkill's classification as a basis but not closely adhering to it, M. R. Ry. C. K. Subra Rao, Rao Bahadur, Sub-Assistant Director of Agriculture, Madras, has furnished a tenative classification of the Madras varieties which he considers better adapted for agriculturists.

The varieties are differentiated, by

(1) Colour of the glumes, of the seed coat. or of the hilum of the grain.

(2) The season at which the variety is sown.

(3) Duration of the growth, though this is not a fixed character, for the result of sowing certain varieties considerably later than usual is to shorten the period of growth.

(4) The character of the inflorescence; that is, whether it be open close, or bent over, the arrangement of the seed thereon; and whether the grain (glume IV) is awned or not.

(5) The number of nodes or leaves.

(6) The flavour of the straw or grain.

Andropogon Sorghum Brot. described from a specimen of *Kaka Cholam* grown in Craig Garden (5,200 feet) gathered 9th September 1906, the seed having been sown on 11th April 1906, Perennial, stem 7 feet or more, (Sir George Watt says of the species generally, in India a height of even 12 to 15 feet would be nothing extraordinary) Stout, from the underground portion many suckers are sent up, nodes glabrous; leaf 19-27 inches × 1½-2 inches, tapering to an acute tip and downwards to a narrowed round base, flat, glabrous, margins minutely serrulate, midrib broad, white above; sheath, mouth auricled, smooth, almost as long as, or much shorter than the internodes; ligule short, membranous, ciliate. As regards vegetative character this description generally holds good for the varieties cultivated in Ceylon. The panicles and glumes vary.

Kaka Cholam, panicle erect, pyramidal, rhachis stout, 4 sided, grooved, smooth, branches slender, whorled and alternate, angled, scaberulous, branchlests filiform, scaberulous; spikes up to 1 inch, decompound, of 4 or more pairs of spikelets, sessile spikelet glumes 1 II subequal, oval, with membranous acuminate tips, yellow, turning red and finally black, glume IV with short awn or 0 in its sinus.

Arisi Cholam, panicle very loose, bent over, drooping, pedicles 1-2½ inch long; very hairy at base of spikelets, glumes gaping when ripe, but subequal or if anything longer than ripe seed; grain globular, ovate, pearly white, with large oval bordered embryo, glume IV short awned. This is probably what is known in Trichinopoly as Pal or Vell irungu.

Karal irungu, from tea maker's garden, Craig, (4,500 feet) panicle pyramidal, loose, erect, pedicels long; glume I of sessile spikelet, broad ovate, yellow or later reddish, with green marginal veins at its acute tip, very hairy, especially on margins which overlap glume II. Glume II lanceolate, acuminate, smooth, 3 veined at apex with connecting veins between the longitudinal ones, III hyaline, ciliate, IV ovate, ciliate, with short bent awn, lodicules ciliate; grain white. This is closely allied to Arisi Cholam but not identical, they both are very little removed from the wild representative.

I am told that a variety cultivated under the same name in Udu Nuwara has a much larger white grain.

Sen Cholam panicle very compact, oblong ovate, 4×2¾ inches flattened at the top. Seed orange red, oval, when ripe the glumes do not reach higher than half away up the grain, and at this point there is a horizontal line evidently due to cleavage by the ripening grain, the glumes being often split above, veins prominent in lower half. Burkill's mediocris sub var Ruber?

Uses. Boiled and eaten as Conjee, Tamils make it into flour and boil until it becomes a thick paste, known as "Chola Hale or Cool" amongst the Sinhalese Karal Irungu is roasted until the grain bursts and swells, becoming soft and floury, it is mixed with honey and eaten as a sweet, known in Seven Korles and Low Country as "Kordiyal"; it is also given to invalids being considered easy of digestion. It is also made up in a similar way as above but with jaggery and pepper and given by chiefs and headmen to their employés as tiffin, known in Udu Nuwara and Four Korles as "Pore-Aggala." In Ceylon the flour does not seem to be made into bread but in India many varieties are used for this purpose. Bread made from the yellow grain is regarded as the best, that made from the white being hard and tasteless. Other forms of which there are twelve are not allowed to mature but are baked in hot ashes and eaten green, when the grain is tender and in the ear.

Other uses. Many varieties have sugar-yielding stems and it is a curious fact that a sugar-yielding form may, when carried from one country to another, become a grain or fodder form. The thicker and drier stems are used as fuel, in Southern Europe and America a special form of the plant known to botanists as *Var. Technicus* is specially grown in order that (after the removal of the grain) the rigid, strong, much branched fruiting shoots may be employed as natural brooms, and special qualities for small hand brushes or Whisks. Hackel writes, from the fruit the Caffirs make "Tialva" and the Negroes "Merisa" alcholic drinks. The fruiting glumes contain useful coloring matters.

As Fodder. Many of the varieties are cultivated in India exclusively for fodder in which case they will as a rule be sown out of the season appropriate to their growth as a grain crop, with a view to preventing the seed maturing.

It is held in such esteem that there is a proverb current in the Tamil country "Shola payer mayentha nadukku Shorka lokam vanduma. Does a bullock which has grazed on a cholam crop wish for Heaven? As far as I can learn this grass is never grown for fodder in Ceylon and the variety *Kaka Cholam* is considered poisonous and is said to be sowed amongst other cereals as a warning and a deterrent to owners of straying cattle.

A poisonous property is sometimes acquired by the cultivated *juar* in India and if eaten by cattle, especially when it is very young or when stunted by drought or parched by growing on exposed dry rocky soils, has frequently poisonous effects.

That the cultivated varieties possess this property Sir George Watt looks on as evidence of at least the fodder yielding varieties being derived from *Andropogon Halepensis* which is known in certain mountainous countries of India by the vernacular name *Bikhonda*, possibly intended to denote its somewhat evil reputation;

The poisonous properties of Sorghum were at one time supposed to be due to decomposition set up by insects, at another by the effect of fungus. In the Agricultural Ledger 1896 No. 24 Calcutta. Veterinary Captain H. T. Pease. A.V.D. F.Z.S. wrote, "*Juar* is mostly grown on highlands and is occasionally irrigated. It is dependent on the rains for its moisture—a delay of the rain or an unusually high temperature, which withers up and stunts the *Juar* is necessary for the production of the change in properties which caused it to become poisonous." Veterinary Captain Pease had the opportunity of inspecting animals that had been poisoned. "On inspection of the *Juar* which had been given to the dead animals, I was very much surprised, on breaking open the stalks, to find a very considerable quantity of a white salt deposited in crystals in the pith, more especially at the nodes. The salt to the taste was cooling and saline, very like Nitrate of potash. On burning a piece of stalk there was marked crepitation.

I collected some of the stalks and subjected them to a chemical examination which revealed the fact that the salt was Nitrate of Potash. The quantity of salt in the stems was so considerable (25%) that there was no doubt in my mind that this was the cause of the deaths of the cattle which had fed upon it."

This conclusion was confirmed by a further analysis of grass which caused the death of a number of cattle at the Sirsa fair. A heifer given 10 ounces of the drug in a drench died in 20 minutes.

Sir George Watt writes † On the other hand, Dunstan and Henry (Philosophs. Trans of the Royal Society (199 A), 399) in a very learned paper on the Cyano-genesis in plants have shown that the poisonous property of immature Sorghum is due to the presence of prussic acid originating in a new glucoside named *dhurrin*. But it should be observed that these authors expressly say that the prussic acid has only hitherto been detected in "the young plant."

Whatever may be the cause of this grass developing poisonous properties it is evident that it should be used with caution as a fodder, though I cannot hear of any authenticated cases of cattle having died after eating it in Ceylon.

THE OBJECTS AND PLAN OF HEELEAKA EXPERIMENTAL STATION.

By H. H. Mann and C. M. Hutchinson.

The culture of tea has long been recognised to be one of very special character. In few other agricultural crops is it the leaf which forms the commodity for whose production the crop is grown, and in most of these, the plant which is cultivated is an annual one. In the few exceptional cases, like the mulberry, where a perennial tree is grown for the production of leaf, the methods by means of which this is done bear little or no analogy to those of tea culture. It is no wonder therefore, that the history of the tea industry in India is the history of experience bought by many failures, and one has only to read some of the early records of tea culture in Assam, to recognise how utterly unprovided with correct information the pioneers were.

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* Department of Agriculture Madras, Vol. III, Bulletin No, 55,

† The Agricultural Ledger Calcutta, 1905—No. 6.

Since that time, much progress has been made. In large measure, the character of the land most suited to tea has been determined; the method best adapted for the successful treatment of the young tea plant, and for making the largest quantity of the best leaf, are partly known, though those who have had the greatest experience differ widely in their opinions. The best system for the renovation of deteriorated tea,—a problem facing tea planters and tea owners daily in India,—is likewise a matter on which the greatest differences of opinion exist. Beyond these purely practical matters, little is known of the relation of the various operations of tea culture to the composition of the tea leaf, and hence to the quality of tea.

And yet the settling of these questions, and the obtaining of this information is of vital importance to the tea industry. Long and elaborate investigations have been required in ordinary agriculture to obtain the restricted understanding which we have, of what is required for the best results among ordinary farm crops, but nothing corresponding has been attempted with tea. All, in fact, that has been done has been the collection of existing information, the analytical examination of large numbers of Indian tea soils in Calcutta, as well as of samples of tea produced on the soils in question. The information, thus obtained, has led to many conclusions, some of which have been adopted with success in actual practice, but it is evident that such conclusions, before they can carry conviction, require, in addition to what has been already done, careful testing on the spot by those who can give the time and have the necessary training for the purpose.

It is with the object of giving this careful testing to conclusions formed on other grounds, and to experiment with a view to drawing other conclusions that the Indian Tea Association decided during 1903 that they would establish an experimental station in the Assam Valley, to be placed under the control of the scientific officers attached to the Association, one of whom came from England, expressly to undertake resident charge of such experiments as might be initiated.

SITE OF THE EXPERIMENTAL STATION.

After long consideration, it was decided to accept an offer made by the Scottish Assam Tea Co.. of land on their tea estate at Heeleaka, near Moriani, Assam, for the commencement of the work. The tea, offered and accepted for the first work, is old. It was planted between 1862 and 1865, and is hence, at least forty years old, though many of the bushes are of course much younger than this. It is only of moderate hybrid type and it may be supposed both from its age and character of the land that both the plants and the soil are considerably exhausted. The latter fact is essential for any experiments in the effect of manures, for if the soil be rich the result of any manurial application will naturally be minimised. The land, like most of that in the Jorhat dirtriet of Assam is very light and sandy, on which water rarely, if ever, stands, but which needs good main drainage if the excess of water is to be quickly removed from the land, as it should be.

Before giving an account of the actual experiments both proposed and in progress, it will, perhaps, be well to indicate the class of problems to be faced, and the special difficulties which occur in the case of tea.

METHODS OF AGRICULTURAL EXPERIMENT.

In experimenting with annual crops, there are usually three problems to be solved, namely the effect of the treatment adopted (1) on the yield, (2) on the quality, (3) on the capacity of the land for future crops, Most of the experiments carried on have limited themselves to solving point (1) a few have given information as regards points (2) and (3) In the case of tea these questions are all of great

importance, and to them must be added another, (as in the case with all perennial crops) (4) the effect of the treatment on the plant itself. In any experiments which may be made, if the information is to be complete, we must determine.

(1) the resulting increase or decrease in outturn of leaf,
(2) the change in the character and quality of the leaf,
(3) the increased or diminished capacity of the soil for producing further crops.
(4) the change in the character of the bush.

VARIATIONS IN OUTTURN.

Of these points the first, is, at first sight, easy of accurate measure; it seems only to depend on exact weighments of leaf from the differently treated areas at each plucking, and the arrangement that the same pluckers shall visit different plots at each round. But this is not enough. One day the leaf comes in wet, and this wetness cannot be allowed for with any accuracy. The same weight of leaf at different seasons will make different amounts of tea depending on the water naturally present in the leaf, which constantly differs. It is hence absolutely essential not only that the leaf weights be carefully and accurately taken, but that the actual weight of dry material should be determined on each occasion, on the leaf as weighed in from the garden.

VARIATIONS IN QUALITY.

The second point—the determination of the quality of the leaf—is however, the most difficult matter of all, and we cannot pretend to have, by any means, solved it. The method which at first appears the natural one, is to make the leaf into tea, and get the latter valued; but, save in very exceptional cases, this is obviously impossible, unless such large areas are treated that all hope of their being naturally of even character is lost. Furthermore, it is quite probable that slight changes in the method of manufacture will lead to teas which are of different character and hence not directly comparable by a tea taster. We are, therefore, compelled to adopt some method of analysing the leaf as it is received from the garden, if any conclusions as to the effect of the treatment on the quality is to be obtained. A satisfactory method of analysis is, however, still to seek. But, in the meantime, we can obtain a very fair idea of the relative commercial value of leaf grown on the same place and under otherwise similar conditions by getting to know the maximum amount of matter disolved by water under constant conditions more or less resembling those used in actual tasting. In carrying this out we have, however, had to diverge considerably from tasting conditions, which are not exact enough for our purpose. For instance, in tasting the result is known to depend materially on the amount the leaf is broken up, hence all our samples have had to be reduced to a standard size, and the only possible exact one was a very finely divided powder. The method finally adopted is given in technical language in the foot note below, but the relative quantities of leaf and water are very similar to those used by tasters. In the liquor obtained we intend also ultimately to determine the amount of tannin, the source of pungency and, when fermented, of colour in tea; and the quantity of caffeine. The determination of flavour is, at present, beyond the resources of analysis. The constituents in the leaf which are insoluble in water, have no direct practical interest, and hence are not dealt with. Such a method may be considered as giving us at present the best means of judging of the relative value of two lots of leaf, provided of course, the land and situation, and condition of growth are similar.

Five grammes of the dried leaf ground so as to pass through a sieve of 60 meshes to the inch, are weighed out into a 250 cc. flask, 200 cc. boiling water are added, and the whole shaken for 3 minutes in a shaking machine, and then heated in steam for ten minutes. 1½ minutes shaking follows, and the liquor is made up to the mark with boiling water. After thorough mixing the whole is rapidly cooled in water, made up again to 250 cc. and filtered. 50 cc. of the filtrate is evaporated to dryness and weighed.

EFFECT OF TREATMENT ON SOIL.

The third necessary point to determine a complete investigation of the effect of any treatment is its influence on the soil. As a rule its estimation can only be made by continuing the experiment over a long series of years. Our methods of soil analysis are far too clumsy to be of any value in discovering the slight changes produced by any application in one year. The means to hand with annual crops of determining the point by growing a second crop and making the latter the test of any change in the soil is not possible in our case; and hence it is only feasible to get at the result by continuing the experiment for a long time.

EFFECT OF TREATMENT ON THE BUSH.

The same long continuance of the experiments is required for ascertaining the effect of a treatment on the bush itself. But, in this case, the progress can be measured annually, to a certain extent, with more ease. All old tea is uneven—this is a necessity of the case. If we classify the bushes at the begining of a treatment and go over the same ground at the end of each season, the change in the proportion of good, medium, and poor bushes will give us a measure of what the treatment is doing. In all comparative tests on old tea, the same classification is necessary for another reason. However even a piece of tea looks to the eye, when it is divided into sections, it will be found that these are not equal. Hence when old tea is made use of, before any comparative work can be done, we must know the relative value of the bushes in each plot, and correct the figures of leaf weights accordingly. In laying out the Heeleaka experiments, where very old tea had to be dealt with, the bushes were divided into ten classes varying from worthless ones for yield (Class 0) to the best of all (Class 9.) Every bush, on all these areas utilised, was hence mapped, and by adding together the values assigned to each bush the original relative value of each plot is ascertained. This will be repeated at the end of each season and so a measure of the change in the permanent condition of the bushes by the treatment will be obtained. We have now indicated the points to be ascertained in a series of experiments, and the general methods which are being adopted to get at them. We must now specify in more or less general terms what are the problems which await solution, and which are being or will be tackled at the Heeleaka station.

MANURIAL EXPERIMENTS.

First and foremost, undoubtedly, stands the question of the effect on yield and quality of the bushes, of materials added to the soil as manures. It is generally recognised, that the principal chemical ingredients of plants which must be supplied from outside in exhausted soils are (1) nitrogen with which organic matter is closely associated, (2) phosphoric acid in some form or other, (3) potash, and (4) lime. But, hitherto, little definite information has been at hand of the results of the application of any of these in the case of tea. The last constituent mentioned above, lime, is extremely deficient in almost all tea soils, and hence nearly all English analysts, consulted about the manurial experiments of tea soils, have specified lime in large quantity as an essential ingredient in whatever fertiliser was added. Whether these opinions are correct is extremely doubtful, as, according to our experience, the tea plant is damaged by more than a very small quantity of this constituent. The matter needs setting at rest,—and in our manurial experiments there have been arrangements made to compare the effect of adding (1) lime alone (2) lime with organic manures like oilcake, with (3) a plot to which no manure is added.

We may for the present, take the next two constituents specified above together—phosphoric acid and potash. These seem to have a close connection with the quality of the leaf, and their addition forms, hence, a most important part of

any investigation on manurial treatment. Hitherto their use has not been very successful in the Indian districts, (though Phosphoric Acid is very deficient in many of the tea soils), but they have been utilised in large and constantly increasing quantities in Ceylon. They may be applied in three ways,—as an artificial acid phosphate (Superphosphate), as basic slag, or as bones. Bones have been omitted, for the moment, but their investigation must certainly come a little later. On the other hand, plots have been laid out (in the same series of experiments above indicated for lime) to which are added (1) superphosphate and potash (2) basic slag and potash, (3) superphosphate and potash with nitrogenous manure as nitrate of soda, (4) basic slag and potash likewise with nitrate of soda.

The manures in which nitrogen and organic matter are the chief valuable constituents remain. We may have nitrogenous manures containing no organic matter like Nitrate of Soda, or Sulphate of Ammonia,—the latter a waste product from gas works. These are usually quick acting, but their effect rapidly disappears. We may, on the other hand, have nitrogenous manures, in which the nitrogen forms part of vegetable or animal matter. Such are the various classes of oilcake, and cattle manure, hitherto the most commonly used materials in the Indian tea districts. In connection with them another question arises. It has been customary to apply the oilcake, for example, at the rate of about 15 maunds per acre once in three years,—or the cattle manure in large quantities at long intervals. Would it not be more effective to add, say, one third the quantity each year, and so give a slight annual stimulus rather than a stronger one at less frequent intervals? Taking this into account, the complete set of these manurial experiments, as at present laid out, consist of nineteen half-acre plots treated as follows:—

Number of Plot	
1	Untreated.
2	Sulphate of Ammonia, 2 cwts. per acre.
3	Nitrate of Soda, 2½ cwts. per acre.
4	Superphosphate (3 cwts.) and Sulphate of Potash, (2 cwts.)
5	Basic Slag (5 cwts.) and Sulphate of Potash, (2 cwts) per acre.
6	As in 4, with Nitrate of Soda, 2½ cwts. per acre.
7	As in 5, with Nitrate of Soda, 2½ cwts. per acre.
8	Untreated.
9	Local Oil Cake, 15 maunds per acre, *once in three years.*
10	Local Oil Cake, 5 maunds per acre, *each year.*
11	Castor Cake (from Calcutta) 15 maunds per acre, *once in three years.*
12	Castor Cake (from Calcutta) 5 maunds per acre, *each year.*
13	Cattle Manure, 20 tons per acre, *once in three years.*
14	Cattle Manure, 6⅔ tons per acre, *every year.*
15	Lime 15 maunds per acre.
16	Lime, 15 maunds per acre and local Oil Cake, 15 maunds per acre.
17	Green Manuring with *mati-kalai*, every year.
18	Green Manuring with *mati-kalai*, every second year.
19	Superphosphate (3 cwts) and Sulphate of Potash (2 cwts) and Green Manuring with *mati-kalai.*

It will be noticed that we have introduced three plots on which the principal manurial treatment used is green manuring with *mati-kalai* (*Phaseolus Mungo*) applied annually or at intervals. This is supplementary to a separate series of experiments on various green manures, and will enable us to compare the effect of such dressings (which cost under five rupees per acre) with the much more expensive manures applied.

It will be noticed that half an acre is the minimum size of each plot. We intend, in nearly all field experiments for the futnre, to keep to this size. It contains, usually, roughly, a thousand plants—a number which is quite few enough to do away with individual variations in the bushes. At the same time, with an acreage of much more than an acre it is difficult to get a sufficient area of even soil or even tea for many plots. But half an acre in the season gives from thirty to sixty pounds of leaf or more per plucking, a quantity which is, hence, enough to weigh without difficulty. The plots are always divided by a row of unpruned bushes. thus rendering the boundaries of the plots absolutely distinct. These unpruned bushes will be kept to a height of, say, four feet.

EXPERIMENTS ON GREEN MANURING.

While speaking of manures, it will be well to insist on the importance of experiments with "green manures." This method of manuring as is well known, consists of growing a crop of some sort, usually a leguminous crop, among the tea and hoeing the plant into the land when it has grown to a sufficient size. With us in North India, *mati-kalai* (Phaseolus sp) has been almost exclusively used; in Ceylon, Crotalaria Striata—a plant apparently not cultivated in the Indian tea districts—, and ground nuts have been found of greatest advantage for this purpose. There is also another type of green manure, which consists of growing a more or less permanent bush or tree among the tea and hoeing in prunings from this bush or tree at intervals during the year. In India the *boga medeloa* (Tephrosia candida) has been chiefly employed; in Ceylon, the *dadap* (Erythrima sp) is being introduced. It is obvious that these may or may not be the best, and it is intended from time to time to try any green manures which offer in the hopes of discovering something which will do better than any of the above. In 1905, half-acre plots have been set out to test the relative value of *arahar* (Cajanus indicus) *mati-kalai* (Phaseolus mungo), *Crotalaria Striata*, *dhaincha* (Sesbania aculeata,) and ground nuts and it seems likely that already one or two of these crops will prove better than those hitherto sown for the purpose.

As has already been said, it is hoped in the near future to make careful tests with bones, in various forms, but it has not been found feasible to take these in hand during the present season.

We can pass over more shortly some of the purely agricultural questions which it is the intention to study at Heeleaka when time and space allow. Such are questions of the water in the soil and drainage; questions of cultivation, the amount, time, and depth of tillage, the advantage of a growth of jungle and what weeds are favourable or reverse.

But there are special agricultural matters affecting tea such as pruning and plucking on which definite well founded results are of importance.

PRUNING EXPERIMENTS.

In connection with pruning. there still remains very much difference of opinion as to the method which gives the best result. Shall we clean out all the small twigs from the bushes; shall the sides be cut as close as the centres; shall the new wood be cut as short as possible or left several inches in length; shall pruning be carried out early, as early in the season as possible; or be deferred as late as may be?—these are some of the questions on which the best of planters differ in opinion. In order to commence this study we have laid out during the present season, six plots, each an acre in extent, and have light pruned them as follows:

No. 1 and 6 are treated according to the custom of the district with only slight cleaning out of twiggy growth, removal of weak side shoots and trailing branches.

No. 2 is thoroughly cleaned from weak growth whether at the side or centre, and the new wood is cut to an equal length of 1½ to 2 inches all over the bushes.

No. 3 is table pruned, that is to say is cut flat across the top, two inches of new wood being left in the centre of the bushes, and no cleaning is being done.

No. 4 is likewise, table pruned, but four inches of new growth is left on the bushes.

No. 5 is pruned on a system which has been very successful on the 'Bhagjan' garden of the Amgoorie Tea Company, and we propose to call it the 'Bhagjan' system. Very little new growth is left, not more than half an inch, it being the object each year to make the new growth arise not from the new wood but from the old knot. This pruning will take several years to get into operation, but a start has been made during the present season.

The yield of leaf both to the acre of land and to the square foot of bush surface will be obtained, and, in addition, the composition of the leaf and the effect on the bush itself will be noted as usual. This experiment will certainly give very valuable guidance for future investigation in this direction.

The question of heavy pruning will be taken up very shortly. It may be remembered that the Tea Association has now been carrying out experiments in heavy pruning, for some years in several districts of Assam. Very definite results have been obtained, and are almost ripe for publication. These will form a very valuable guide for approaching more closely the investigation of the very many problems offered by heavy pruning in tea.

PLUCKING EXPERIMENTS.

The method of plucking of a tea estate vitally affects the yield, and, if such is possible, in an even greater measure, the quality of tea. The methods used. however, differ essentially, conditioned, it may be, partly by questions of labour, but also by differences of opinion as to the procedure giving the best results. Thus in Upper Assam there are two essentially different plans in vogue. After leaving enough growth in both cases, the one and more usual method is to go regularly round the tea every seven or at most eight days, taking at each round the ready leaf, that is to say only those shoots which contain a fully formed "two and a bud," leaving the necessary amount of growth below—which varies with the season: the other which has come to be known as the 'Sadiya Road' system, goes round the garden usually, in not less than ten days, but at each round takes everything whether it be 'two and a bud', or 'one and a bud' which is on the bush above the number of mature leaves which has been decided, for the time, to leave. As a rule on this system, the whole growth is taken, that is, in local terms, the leaf is plucked 'down to the *janum*,' much earlier in the season than under the former system. To the adoption of the second plan thus shortly described a good deal of the high quality of the Sadiya Road tea has been ascribed by some; and to test this point, and also its applicability in another district, duplicate plots plucked by either method have already been laid out at Heeleaka in 1905.

This is only one of the problems of plucking—others concern the necessary amount of growth to be left after pruning before a bush can be plucked; the relative advantage of plucking fine on long shoots, and on freshly grown shoots (close plucking), the so-called 'Alleyne' system, the treatment of *banjhi* shoots, and so on. These are all susceptible of investigation, which it is intended to undertake at Heeleaka as occasion allows.

OTHER PROBLEMS.

We have spoken of the treatment of mature tea. But there are many questions which can only be settled by growing tea ourselves from seed; the relative effect of various treatments on different types of a tea; the botanical differences of jats, and their identification: the advantages of methods of pruning a bush in its early life, of encouraging a long taproot and of various other kinds of root growth; and so on. We are making arrangements for planting out nurseries of several of the best types of Assam indigenous, and of Manipuri tea seed,—and also probably of Lushai and Naga seed during the cold weather of 1905-06—and results from these experiments ought quickly to be obtained.

This short sketch of a few of the more obvious problems awaiting solution, and which it is intended to tackle is, of course, very incomplete—but it will, we think, give an idea of the class of question we are anxious to investigate and which the existence of Heeleaka station will give us the opportunity to touch. We should like it to be thoroughly understood, however, that any matter which arises in practical planting and which is capable of decision, the Heeleaka station will be ready, as time and opportunity allows, to take up and enquire into until definite conclusions are obtained.

It will be evident that many matters cannot be decided here. Everything which depends on differences of soil or of climate will demand several such stations for their investigation. The results obtained will, in fact, always be subject to modification when applied to land and districts other than those in which they have been obtained. In many cases, what such modification must be will be evident; in others similar stations in other districts and on other land will be required and it is possible that in years to come they may be supplied. This is, however, for the future. At present, there is plenty of scope for the work of the Heeleaka station in getting results which will be of general application, and which can be utilised by planters all over North East India.

So far we have only dealt with problems of tea culture: almost equally important are those of tea manufacture, which will also have as much attention as can be given. Our knowledge of the processes going on during manufacture has very much increased of recent years but much remains to be done before all is understood and alterations produced in the tea by modifications of the process are completely grasped. This is, not, however, the place to go into these problems. Primarily the Heeleaka station is one for the tea culture, and its success will depend on the progress it makes in clearing up the moot points which still remain in the best treatment of the soil and the plant for producing the largest quantity possible of the best quality of tea without injury to the bushes. (Bulletin, India Tea Association.)

TEA CULTURE IN JAPAN.

TEA PRODUCING DISTRICTS.—The chief tea-producing districts in Japan lie between the 34th and the 36th parallel of latitude. Of these the most important centres are those of Shizuoka prefecture, comprising the provinces of Suruga and Tōtōmi and of the Kyōto urban prefecture with its headquarters at the town of Uji. Tea can be grown in suitable places as far north as 40° N., but the plant cannot be cultivated with any great success north of the province of Echigo. The following is a list of those prefectures which produce over 150,000 kwan (about 1,250,000 lb.) of tea annually:—Kyōto, Ibaraki, Nara, Mie, Shizuoka, Higa, Gifu, Yamaguchi, Kōchi, Fukoka, Kumamoto, and Kagoshima; of these, Kyoto, Shizuoka and Mie average 400,000 Kwan (about 3½ million lbs.) and above per annum.

Kinds of Tea.—The tea produced in Japan may be divided roughly into four classes:—

1. Hikicha or tencha—powdered tea—only used for the "cha-no-yu," or tea ceremony, or on very State occasions.
2. Green tea, (a) Gyokuro—pearly dew—costing from 7 to 10 yen or even more per pound (*b*) Sencha, the second quality of green tea, ranging in price from 30 sen to 3 yen per lb,—the tea ordinarily drunk by all but the lowest classes unable to afford any but
3. Bancha, consisting of last year's leaves, withered stalks, chopped branches, etc., and costing about 10 to 15 sen per lb.
4. Black tea and Oolongs.

Tea Plantations.—The best ground for tea plantations is a moist, sandy loam, situated on the lower slopes of hills, but the level plain is also suitable provided that the drainage is satisfactory; thus the famous Uji tea gardens lie mostly on the level plain, lying on both sides of the Ujikawa. Terrace-culture is sometimes seen, though it is infrequent, but tea bushes are never planted on the sides of steep hills.

The tea tree averages about 3 to 4 feet in height; that which produces the best sorts of Uji tea often grows, however, to full 6 feet. Sometimes other plants are grown between the tea bushes, such as mulberries, plum trees, etc. In the Shizuoka district pears are frequently grown on trellises above the tea plant, but though ground is economised by this means, the sun is kept from the shrub, which consequently suffers to a certain extent.

Manuring.—A very important part of tea culture is the manuring. This is done sometimes three or four times a year, chiefly in spring and autumn. The manures generally employed are natural manures and oil cake, with the addition in some places of rice bran and fish manure, the latter is not used at Uji.

Trimming.—The shrub is trimmed after the first crop and again in winter, generally in December, when the production of sap is at its lowest.

Picking.—The ordinary life of a tea bush is about 20 to 25 years. It is first picked in the third or fourth year after sowing, and is at its best from the eighth to the fifteenth years. Two crops are usually obtained in the course of a year—the first during the month of May, and the second in about the middle of June after the rains. Sometimes a third crop is obtained, but the leaves of this third crop are tougher and serve principally for bancha and the cheaper sorts of sencha; a certain amount is refired for export. In any case it is the first crop that gives the best tea.

The picking of the leaves is done by women, who receive from 25 to 30 sen per diem; a good worker will pick about 35 to 40 lb. per day. As soon as possible after this the preparation of the leaves begins.

Sencha.—Sencha is a very comprehensive term and ranges from second quality Uji tea to that grown under protective mats (namely, gyokuro and hikicha), costing 1 yen 20 sen upwards, down to the drink of the poorer classes at prices so low as 15 sen per lb,—inferior indeed to the better sorts of bencha. As it thus forms the bulk of the tea consumed in Japan, it may be convenient to deal with it first.

Steaming.—Steaming is the first operation. This is done over a large iron kettle full of boiling water, immured in a brick fire place containing a strong wood or charcoal fire. In the mouth of the kettle a brass wire sieve is fitted, in which about 3/4 lb. of fresh leaves are placed. The steam is allowed to act on the leaves for about four minutes, when the sieve is taken off and the leaves are shaken in

the hands and spread on mats to cool. The above procedure is that adopted in the Shizouka district; the chief differences to be observed at Uji are, firstly, that only bamboo-bottomed sieves are used, and, secondly, that a lid is put over the leaves while steaming, which operation then only takes two minutes.

FIRING APPARATUS.—The leaves are next subjected to the important process of firing. The apparatus for firing consists of an oblong bamboo frame about four feet long by 2½ feet wide and some 3 feet in height, coated with mud. This serves as the hearth and glowing charcoal or wood and straw are piled up on the floor inside. Above this is fitted a tray like that of a trunk, about 6 inches deep, with wooden sides covered with thick bast paper; the bottom of the tray also consists of the several thicknesses of the same material.

The operation of firing is most fatiguing as well as difficult. Only the strongest men are able to stand the heat and the long hours, which are from day break to 6 p.m. in the busy season. The fire must be kept at an even temperature, as when in this state the leaves are very delicate and réquire extremely careful treatment. A good workman will earn 80 sen per day.

PROCEDURE EMPLOYED IN FIRING.—The workman first smears the surface of the paper with rice paste, which is allowed to dry; this gives a hard, polished surface. After this about 3 lbs. of the steamed leaves are poured into the tray, and the workman turns them over and over until their edges begin to curl with the friction and with the heat of the fire. He then begins working them with his hands, rubbing them between his palms and shaping them into balls which he breaks and reforms. As he works he picks out the stalks, dried leaves, dust, etc., and puts them on one side. The fresh green colour of the leaves gradually changes to a dark olive hue, and the fragrant odour of the tea becomes perceptible. The mass shrinks in size as the moisture evaporates, and it is finally pronounced to be dry; it is seen that each leaf is separately twisted and rolled. The whole operation of firing lasts three hours. The tea is then spread out on paper frames similar to those used for firing, and left until the leaves become quite brittle. The tea destined for export is now ready for the wholesale merchant. and is despatched to him packed in thick cartridge-paper bags. If destined for home consumption the leaves are sifted with bamboo hand-sieves of three or four degrees of fineness, and the stalks still remaining are then picked out by hand; in the case of the cheaper sorts of tea this hand sorting is omitted.

PROCESS FOR REMOVING SUPERFLUOUS MOISTURE.—Leaves picked in rainy weather contain excessive moisture, and it is necessary that this be removed before they are fired. After steaming they are placed in a bucket with holes pierced round the side, and on top of them is laid a circular piece of wood of the exact diameter of the bucket. A screw acting on this wood forces it down on to the leaves, and the superfluous water runs out of the holes. Care must be taken that the screw be not turned so far as to crush the leaves.

GYOKURO TEA.—The steaming and firing of gyokuro tea are not essentially different from the processes employed for sencha but the method of growing it exhibits some peculiarities.

TEA GARDENS.—Towards the middle of April the tea bushes are roofed over with a light bamboo trelliswork, and about a fortnight later a layer of straw is placed on the top, and straw mats are suspended down to the ground from the edge of the roofing round the four sides of the plantation. The object of this is to preserve the young leaves from the cold dews and from the direct rays of the sun, and to make them soft and tender. Great care and pains are expended on the manuring and trimming of these gyokuro tea plantations, and the bushes have a much finer appearance than those whose leaves are used for sencha.

PICKING.—Before the women are sent in to begin picking, the master of the tea garden examines the bushes and marks those whose leaves are ready by tying a piece of paper on to one of the branches. By this means the uniformity is obtained as none of the leaves are picked until they reach a certain stage of development.

PREPARATION OF LEAVES.—The leaves are first of all roughly sorted, bits of wood, large stalks, &c., being removed and thrown away.

STEAMING.—The modus operandi for steaming and firing gyokuro is similar to that employed with sencha, except that more care and trouble are taken. For steaming, a very hot fire is made up, so that the water in the kettle may give off as much steam as possible. A handful of the fresh leaves are now put into the bamboo sieve, which is placed over the kettle for about eight seconds. They are then spread out on a wooden board and cooled by being turned over in the hands and by being fanned, after which they are spread out in flat trays until they are ready for firing.

FIRING.—Gyokuro is fired in the same way as sencha, except that it is done at a rather lower temperature, and thus takes about half an hour longer. After having been rolled on the trays for about one and a half hours the leaves are taken off and spread out on tables, where they are gone over carefully by the hand. Seed capsules, last year's leaves, stalks, &c., are taken out and the remainder is returned to the workman. The latter continues the firing for another hour and then transfers the leaves to a cooler tray for about the same period. The tea is left for another half hour to complete drying, and is finally again sorted and also passed through a number of hand-sieves of graduated finenesses. It now only remains to break the tea up small and it is ready for market. Gyokuro thus goes through four sortings in all—one before steaming, one during firing and and two after firing. Sencha is sorted but twice as a rule, though it is also sometimes gone over before steaming ; tea destined for the foreign market is sorted only once, being passed through a sieve after firing.

HIKICHA (OR TENCHA).—The method of preparing hikicha, also called tencha, which is most expensive of all Japanese teas, is totally different from the above. The leaves employed are the same as those used for gyokuro, and are worked up into either indifferently.

STEAMING.—After being gone over roughly by hand the leaves are steamed for 15 seconds, a lid being in this case put over the sieve while they are on the fire. They are then fanned and spread out on flat bamboo trays.

FIRING.—The firing is done in a very hot room, the temperature of which is over 100° Fahr., with practically no ventilation and the men work almost naked. This work is most exhausting, and, as the hours are very long, frequent rests are necessary. The trays used for firing are similar to those for sencha and gyokuro, but the fires are much hotter.

SORTING.—The steamed leaves are poured on to these trays and are turned over and shaken with a kind of three-pronged fork made of bamboo, after which they are spread out on sheets of cartridge-paper and left to dry for a quarter of an hour. They are then placed on tables, and dried leaves, stalks, &c., are carefully removed.

DRYING.—The sorting completed, the tea is again placed on trays in the hot room and left for at least 12 hours, at the end of which time it is dry and quite brittle.

SIFTING.—After undergoing another sorting similar to the above it is put through graduated bamboo sieves until nothing is left but the delicate young leaves.

PULVERISING.—The tea is finally put in a mortar and ground into powder with

a stone pestle. The production of this tea is comparatively small, and it is destined entirely for the home market and is, further, hardly used except for the "Cha-no-yu" tea ceremony.

BANCHA. *Best Quality.*—The method of preparing bancha may be dismissed in a very few words. The best is that made in some places from the leaves of the third crop. In many of the tea-producing districts of Japan, however, this third crop is made into sencha or sent to be re-fired for export.

Second Quality.—what may be termed the second quality is that formed from the last year's leaves, stalks, &c., rejected from the hikicha, gyokuro and better kinds of sencha. This and the above, though formerly only the drink of the lower classes, is now frequently served at the end of a meal, and is said to be coming greatly in vogue.

Third Quality.—The cheapest and the worst kind, which forms the drink only of the poorest classes, consist of the trimmings of the tea bushes when they are clipped with the shears after the first crop. These leaves and twigs are spread out on mats and left to dry in the sun, after which they are broken up small and are then ready for the teapot.

AVERAGE PRICE.—The average price of bancha throughout the whole country is 1½d. per lb., but it varies very much in different districts—from just under 9d. in Kagoshima prefecture to a fraction over ½d. in that of Kyoto.

BLACK TEA.—Very little black tea is produced, as for some reason the Japanese tea-leaf cannot stand the process of fermentation gone through by the Chinese variety, and does not give good results. It was tried on a fairly large scale some years ago, but without success. Japanese tea is made for the American market, which prefers, so far, the green tea at present produced, and not tea as prepared for the British market.

The only appreciable quantity produced in Japan comes from the Island of Kyushu. Nagasaki prefecture in 1903 produced about 35,234 lb. to the value of £1,411., and Kumamoto prefecture about 89,889 lb. to the value of £1,955, the best comes from Fukui, average 1*s.* 1¼*d.* per lb., but only 971 lb. were produced in 1903.

OOLONG.—Oolong is like black tea in colour and appearance, but has the taste of green tea. In Japan proper even less of this is produced than of black tea, but large quantities are shipped from Formosa, especially to New York.

Over three-fourths of the total amount produced in Japan comes from Higa prefecture, in which 52,132 lb. were produced in 1903.

USE OF MACHINERY.—No machines are ever used in the preparation of either hikicha or of gyokuro, and even in the case of sencha very few are employed in the Uji and Shizouka districts, the whole work of firing and sifting, &c., being done by hand. In some districts, however—*e.g.*, in the Sayama region to the North-West of Tokio—machinery is used, though here also to no very great extent. It is said that it is impossible to procure with machinery the same delicate aroma produced by the old fashioned methods. For working up tea for the foreign market machinery has almost entirely supplanted hand labour; this will be dealt with later. The two machines most used in the Sayayma district are one for partially firing the tea and a winnower.

MACHINE FOR PARTIALLY FIRING TEA.—The machine for partially firing tea consists of a hollow metal cylinder about 4 feet long with a diameter of about 2 feet; the ends of the cylinder are formed of wire netting. It revolves on an axis, worked at one end by a handle; at the other extremity is a charcoal fire, the heat of which is conducted into the cylinder by a pipe, and is then drawn through the middle and out at the opposite end by a fan which revolves in the reverse direction to the axle.

About 14 lb. of steamed tea-leaves are placed inside and, when the handle is revolved, these are caught up and turned over by metal prongs fixed on to the axle passing through the cylinder. After about twenty minutes the leaves are taken out and spread on tables, and the last year's leaves, rubbish, &c., are picked out by hand. At this stage the leaves are moist and damp, and are much in the same state as leaves that have undergone about one hour's hand-firing. The sorting concluded, the leaves are placed in the firing trays and are rolled for about one and a half to two hours, as described above.

Winnowing Machine.—The winnowing machine is really an oblong box about 8 feet long and 3 feet square. raised on legs from the ground. One end is open, and at the other is a large fan turned by a handle. After being taken out of the firing machine, or, if none is used, after about an hour's rolling, the leaves are inserted through a hole at the top of the machine and, as they fall, are caught by the current of air from the fan and carried towards the orifice at the other end of the box. There is an appliance at the top causing the leaves to fall regularly, and not in heavy masses which would not be affected to any large extent by the fan. The dust and the withered leaves are carried right out through the orifice and fall on to the floor, while the good leaves being heavier, drop into a receptacle situated near the fan.

Seats of Industry.—Re-making the tea (saisei), *i.e.*, preparing it for export, is carried on chiefly at the open ports of Kobe and Yokohama, and to a small extent at Nagasaki; but tea is now also fired for export on the spot where it is grown—thus there are now large tea-firing establishments at Shizouka in Suruga, and at Horinouchi in Tōtōmi. That fired at the first-named place comes principally from the province of Yamshiro, but also from the country round Kobe generally. The latter places are supplied almost if not entirely from the Shizouka prefecture.

Leaves Used.—The leaves used are principally those of the first and second crops, the former being better and having a finer flavour. Third crop pickings are also used, but the flavour is not so good. They have, however. a hard leaf and are in demand sometimes for Canada.

Use of Machinery.—As has been mentioned above, in this branch of tea industry machinery has almost entirely supplanted the old methods; and indeed if this were not so the exporter could not keep abreast of modern demands, so greatly has the industry grown.

Tasting.—The tea comes in from the grower packed in heavy bast paper bags. An expert can tell at once by the look of a tea about what grade it is, but not more closely than that without tasting and smelling. Thus, a second crop leaf will look better than a first crop, but will not be of such a sweet cup; teas must therefore all be tasted. With this object a small quantity is weighed out from each consignment and placed in cups of uniform size. Hot water is added and the tea is left to steep for five minutes by an hour-glass. The taster then lifts out the sodden leaves, carefully tests their odour, and then tastes the tea. This tea is never swallowed, partly because the amount of tea which would be consumed in a day if this were done would be injurious to the taster's health, and also because it would blunt his keen delicacy of taste, so necessary for the tea-merchant's business. If the consignment of tea is accepted it is at once ready for re-firing.

Pan-firing.—The pans for firing are of metal, about 3 feet wide by 2½ feet deep, and nearly semi-circular in shape. They are immured in brickwork in two rows, one at a higher level, than, but at the back of, the other, the lips of those in the lower row being about 3 feet from the ground, and those in the upper being about 2½ feet higher. Under the upper row, and therefore at the back of the lower, are constructed charcoal ovens which heat the pans, the

lower being naturally much cooler than those above. The tea is first placed in the pans of the upper level and is turned over and over by a two-bladed helix, shaped something like a ship's propeller, which revolves at the bottom of the pan. It is left for about 25 minutes until it becomes thoroughly dried. From time to time powdered gypsum is put in to give it a lighter colour; young leaves require more of this than older ones. A very little Prussian blue, as much as will lie on a knife's point is also added. This colouring matter is absolutely inocuous and is only put in to give what is called a "facing," without which the tea is not saleable on the American market. About two minutes before the drying is completed a little powdered wax is added to give lustre to the tea; if the leaves are old, more wax is required than in the case of the fresher young ones. When the time comes a lever is pulled and the tea is allowed to drop through an orifice in the bottom of the upper pan into the cooler one on the lower level, where it remains for about 15 to 20 minutes. Here the leaves gradually cool and it is noticed that their colour has changed from olive to dark sage—the result of the gypsum and in a less degree to the polish given by the wax.

Sifting.—After the firing the leaves are passed through the sifter—a machine constructed on the same principal as that used during the first firing described above, only more complicated. This sorts the tea into different varieties—generally nine or ten—according to weight. The heaviest kind is placed on horizontal wire sieves moved horizontally from side to side, so that the finer leaves are shaken through and fall into baskets placed to receive them. What remains is sifted again, and the heavier leaves are placed in another sieve which breaks them up small. The patterns of sieves employed differ to a certain extent in different manufactories, some special types being patented by the inventors. The object of all this sifting is to make the weight and fineness of the leaves as nearly uniform as possible, and it is with this intent that the heavier leaves are passed through several kinds of sieves and finally broken up. As many as forty different sieves are sometimes used in busy times, 26 worked by machinery and 14 hand-sieves. The final result of the various siftings is that the tea is separated into about 20 degrees of fineness and weight—from the coarse heavy leaves which have to be broken up by machinery, to mere dust, which is generally sold locally at about 20 sen per lb. These various kinds are combined according to the discretion of the manufacturer. Sometimes he will combine them all in suitable proportions, sometimes he will only mix half-a-dozen of the medium varieties which are the best and most expensive, and sometimes, to make a cheaper quality of tea, he will take the heavier leaves and add to them a proportionate quantity of the lighter kinds. The best kinds of tea are carefully gone over by hand, but it is impossible to do this with all the various qualities produced by a large manufacturer as the length of time that would be required would make the price prohibitive.

Basket-firng.—This is a much cheaper and simpler process than pan-firing but it is not so much employed as the latter; the figures for the export of basket fired tea being only half those for pan-fired,

Sifting.—The better kinds of tea are generally sifted before being fired; this is done first on horizontal wire sieves moved by machinery from side to side, and the leaves are then passed through hand-sieves; they are not broken up small as are those which are pan-fired, but largely retain their original form and appearance.

Firing.—The firing is done in a large room with a cemented floor, in which circular hearths are constructed at intervals of about 3 feet. Above the hearth, in which is a slow charcoal fire banked up with white ashes, is placed a woven basket about 2 feet 6 inches in length, narrowing in the middle and open at both ends. In shape it is much like a dice-box. In the upper end of the box is a convex lattice-

work bamboo tray with wide meshes, on which is placed about 2½ lb. of tea leaves, spread on thick Japanese paper. They are allowed to remain here for about one and a half hours till pronounced to be perfectly dry, and are then often put into a machine for polishing ; this is, however, sometimes omitted.

COLOURING.—The colouring matter is added to the tea either in the course of polishing or else during the process of firing. No colouring matter is employed for the highest grades of basket-fired tea.

SUN-DRIED TEA.—This is a technical name for uncoloured tea, or tea with a very little colouring matter in it. This is not so much exported as pan-fired and basket-fired tea.

LOSS OF WEIGHT BY TEA IN COURSE OF FIRING.—Tea loses considerably in weight during this re-firing principally owing to evaporation, but also to the removal of stalks, dust, &c.

Pan-fired tea loses about 17 per cent., sun-dried about 15 per cent, and basket-fired about 12 per cent. the best kinds, however, being as low as 10 per cent.

PACKING.—When finished the tea is packed in lead-lined half chests, containing generally 88 lb. Practically all is exported to Canada and the United States, only an infinitesmal proportion finding its way to Europe.

STATISTICAL TABLES.—The following tables must be taken as approximate only, owing to the difficulty of ascertaining the exact amount of tea in the tea producing districts.

In the tables the yen has been taken at 2*s*. 0½*d*. and the kwan at 8.3 lb.

	Quantity.	Value.
	lb.	£.
Gyokuro Tea	612,125	 35,270
Sencha	39,192,302	 985,384
Black Tea	209,351	 4,945
Bancha	15,574,252	 95,201
Total ...	55,588,030	 1,120,800

[Consular Report No. 637, September, 1905.]

THE GROUND-NUT OR PEA-NUT.

(ARACHIS HYPOGÆA LINN.)

Arachis hypogæa is a plant unknown in the wild state. There is no knowledge to be recorded of its early history. How it came into cultivation cannot now be traced. That America gave the race birth is beyond doubt, and it is clear that in the sixteenth century Africa and Asia received it. Since then it has spread, so that the area of its extension is now over the whole of the tropics and into a large part of the temperate regions suited to the vine. Wherever grown its richly oily seeds serve as a food, and during the last 60 years it has obtained a wide use in Europe as an oil seed. Many small controversies have arisen over *Arachis*, and many misunderstandings of the plant. The origin of the plant, the sexes of its flowers, the nodules of the root, have been among the causes. The calyx-tube has been a fruitful source of mistake, and the origin of the name Arachis is hopelessly obscure.

DESCRIPTION.—The genus *Arachis* is a peculiar one of the large order Leguminosae in which it belongs to the sub-order Papilionaceæ. All the known wild species of *Arachis* inhabit Tropical South America, and doubtless the largest member of the genus, *A. hypogæa*, was worked up by the cultivation of centuries

in the home of the race. It is a clover-like plant; indeed, a field of it forcibly suggests a luxuriant crop of clover. The stems may attain a height of 1 to 2 feet, or at times of 3 feet but for the most part lie more or less prostrate on the soil. It is the custom in the United States to plant the rows 2½ to 3 feet apart, when the branches ultimately meeting have a length of nearly 2 feet.

The leaf of *Arachis* has four leaflets placed in pairs, each attached by a motile organ (pulvinulus) to the common leafstalk; like clover leaflets they exhibit sleep movements, each pair folding together at nightfall and remaining thus until dawn. The flowers, which are pea-like and bright orange-yellow, are produced one at a time from large buds at the bases of the leaves. Their duration is but short, for they wither for the most part on the day of their production. Outside the orange-yellow petals is the yellow-green calyx, rather irregularly divided into the five sepals, and below it the long calyx tube (at times ¾ inch long), which to the eye appears to be a footstalk to the flower. At this period the flower has no peduncle, and the ovary lies within the calyx-tube protected by the bracts in the leaf-axil. It is only after the fertilization of the flower that the true peduncle appears.

Not all the flowers fruit; many never advance beyond the blossoming stage, and have been thought to be male flowers. After the fertilization, as the first preparation towards fruit-ripening, the petals and sepals shrivel, while the calyx tube is cut off by a ring at the very base. At this time the true peduncle begins to grow, and turns downwards towards the earth, carrying the remains of calyx and corolla as a cap and appendage over the small ovary. Not until the earth is reached does the swelling of the fruit commence; then the cap just mentioned falls off, the scar which is left by the separation of the style at its base becomes exposed, and the young pod, at first sharp at the end, commences to penetrate the soil. At 1 to 3 inches below the surface, rarely deeper, it ripens in the course of a few weeks into the familiar "earth-nut." The usual number of seeds in a pod is two; one is not uncommon, three rare, and four to five occur only in a form which, according to Heuzé (Plantes industrielles, II. p. 135) is found in Costa Rica.

Any flower whose ovary fails to reach the ground fails likewise to produce fruit. Correa de Mello (Journ. Linn. Soc. XI., p. 254) records an experiment in which he prevented the flower-stalk from penetrating the earth by interposing an object; in the attempt to round the obstacle the peduncle grew to 4 or 5 inches long, but failed, and the immature ovary died without enlarging. Fruiting is thus dependent on the effectual burying of the young pod. It is obvious that the flowers of the upper part of the stem stand in a disadvantageous position, for they can less readily bury their pods, nor do many of them appear to make the attempt. When harvest comes the plants may be raised from the ground and stacked to dry in the fields, the nuts hanging on to their stalks among the roots; then will be seen on the root-fibres little nodules which are transformed rootlets, altered in internal structure, and of a peculiar use to the plant. Such tubercles are common in the Leguminosae and by possessing the capability of absorbing free atmospheric nitrogen enable the plant to gain this necessary food in a way not open to other orders of the higher plants. They are indicated in many figures of Arachis.

It has been said (Eriksson, Studier öfver Leguminosernes rotknölar Lund, 1874) that *Arachis* lacks these tubercles; such is not the case. Several observers have mentioned their existence, notably Lecompte (Comptes Rendus Acad. Paris, 119, p. 302), and specimens from many parts of the world preserved at Kew may be seen to possess them. That they are formed less readily in some soils than in others is stated by Andouard (Comptes Rendus Acad. Paris, 117, p. 298), and may well be the case.

RACES IN CULTIVATION.—The many different forms of *Arachis hypogæa* which exist, admit of a rough classification into "bunched" and "running" varieties. In the one the stems are erect, in the other prostrate, but ascending at the tips. Botanists have seized on this difference as a means of classifying the forms, and have applied the names—inappropriate to an American plant—of *Africana* and *indica*. The former name embraces the running, the latter the bunched forms.*

Typical among running forms is that commonly grown in Virginia; its spreading branches may have a length of two feet, or even more, and pods are borne on them almost to the tip. The "Spanish pea-nut" is an extreme of the other type, with several erect stems and the pods crowded at the base—a condition imposed on the plant by the impossibility of thrusting nuts from upper flowers into the soil. Between these two extremes fall the many forms dispersed over the world; we possess but little information leading to a determination of their relative merits.

Upwards of three-quarters of the nuts grown in the United States are sold in the streets for eating. Those most in demand are the Virginian, on account of the relatively small percentage of oil which they contain. Virginia produces two forms; one, as described, "running," the other "bunched." The pods of both kinds are large and white. Tennessee grows two forms—"white" and "red," so-called from the colour of the seed-coats. The former is a running variety closely resembling the Virginian form; the latter, with seeds less agreeable to the taste, is more or less erect in habit, and favoured as a forage crop. North Carolina grows a form resembling the African plant in habit, with heavier and smaller pods than those of Virginia; and Georgia produces a red-seed form, bunched, and with three or four seeds to the pods. The so-called "Spanish pea-nut," grown in the United States, is a bunched form, alike in favour for forage and for confectioners' purposes on account of the sweetness of its seeds. Costa Rica produces the form named earlier, whose abnormally long pods contain four or five seeds; in the Argentine one with orange-yellow husks in common.

African forms, despite the application of the name *africana* to the bunched group, are for the most part semi-prostrate. On the Senegambia coast two forms exist, taking their names from the place names

African forms, despite the application of the name *africana* to the bunched group, are for the most part semi-prostrate. On the Senegambia coast two forms exist, taking their names from the place names of Galam and Cayor. The Galam nut is that which chiefly supplies the exports of West Africa. Rufisque has been the chief port of shipment; thence the British Colonies of Gambia and Sierra Leone obtained seed, and practically throughout these dependencies this is the form cultivated. The Cayor nut from Senegambia is coarser, thicker-husked, and yields an inferior oil. Egypt produces a very prostrate form. On the Mozambique coast a rather small-podded plant is cultivated (W. W. A. Fitzgerald, *Travels*, London, 1898.

Very little information is to hand concerning the varieties met with in Asia Like the African, the Indian plant is semi-prostrate. Two forms, differing in the

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* Arachis hypogæa, var. africana, F. Kurtz in Verhandl bot. Vereins Brandenberg, 1875, p. 45 is A. asiatica, Lour. Flora Cochinch. p. 430, and the "Arachide d'Afrique" of Cordemoy in Andansonia vi, 1866 p 249; while A. hypogæa, var. indica, F. Kurtz is A. africana, Lour., the "Arachide de l' Inde" of Cordemoy.

De Candolle's var. glabra (Prodromus II. 1825, p. 474) is a hairless form; Hasskarl's var. aegyptiaca (Retzia I.. 1855, p. 190) is a prostrate form which he thought perennial; Harz's varieties *reticulata* and *vulgaris* (Samenkunde II. 1885, p. 643) are defined on the conspicuous or obscure reticulation of the pod; we need not concern ourselves further with them.

colour of the seed, are grown in the Malay Peninsula and in Java; two forms are reported from Trincomalee in Ceylon (*Tropical Agriculturist*, III., p. 567), two have been introduced into Queensland and North Australia, and two exist in Japan.

Handy (U. S. Dept. Agric. Farmers' Bulletin, No. 25, 1896, has gathered together the following analyses which place Japanese nuts as richest in oil, in the next rank those from the Tropics of the Old World, and those from North America last. His analysis of Alabama nuts is vitiated by an obvious miscalculation, and we omit it.

Origin.	Percentage in dry substance.					
	Water.	Oil.	Pro-teids.	Soluble Non-nitroge-nous matter.	Fibre.	Ash.
Japanese:						
"Tojin-mame"	7·50	54·60	26·49	12·64	4·32	1·95
"Nankin-mame"	15·61	54·54	32·66	5·99	4·88	1·93
Tropics of the Old World:						
Congo	5·01	52·88	28·33	14·51	1·55	2·73
Rufisque	4·59	52·48	29·73	14·02	1·24	2·53
Egyptian	—	52·30	22·97	20·27	1·61	2·85
Bombay	7·71	50·47	33·73	10·15	2·33	3·32
Southern United States:						
Tennessee (1888) crop ...	3·87	49·35	28·65	17·23	2·37	2·40
,, (1889) crop ...	4·86	48·60	27·07	19·39	2·52	2·51
Georgia...	12·85	43·13	30·49	21·86	2·34	2·18
"Spanish," grown in Georgia	13·15	41·17	32·18	20·43	3·50	2.72

Other analyses may be found in Church, *Food Grains of India*, p. 127, Schädler, Technologie der Fette u. Ole, and in the Journal de Pharmacie, Chim., sec. 4, XVIII, Heuzé (Les Plantes industrielles, Paris, 11,,) places the yield of oil of Spanish grown nuts at 60 per cent; we are unaware of the authority whence he drew the statement, but believe the amount exaggerated.

VARIATION WITH CONDITIONS.—Statements are made to the effect that the hotter the climate in which the seed matures the greater its oil contents. The first indication of this idea is in the following sentences from the *Annual Report of the United States Department of Agriculture*, 1870, p. 93:—"It is possible that the farther south the nut is grown the more oil will be developed in the seed. The Algerian growth furnishes 25 to 27 per cent. The quantity of oil in the Virginian growth is less than that of Algiers." The last is in the new edition of Semler's Tropische Agrikultur, II, 1899 (dated 1900), p. 457, where we read:—"Like castor oil seeds, ground nuts are richer in oil the more tropical the climate under which they are cultivated. West African nuts from near the equator contain 50-55 per cent. of oil, North American only 25-27 per cent., and at times only 20 per cent." Despite the important bearing of such a generalisation, we have been unable to find trustworthy analyses which can be produced in support of it. Those which have been given above emphasise racial differences rather than variations due to the available solar energy. The contention is, however plausible enough, and may be illustrated by bringing forward the relative poorness in oil which makes nuts from Virginia and the more northern States to be preferred for eating over those from Georgia, Tennessee, Florida, &c.

Proceeding to the effect of the soil upon the plant, there is indication that the oil-contents of the seed fall short in poor soil. Subba Rao (*Bulletin, Dept.*

Land Records and Agric., Madras, 1893, p. 280) says, the seeds from soil new to the crop are richer than those from village sites, and from red sandy loams richer than those from clays. Seed produced on un-irrigated land is richer in oil than that produced under irrigation.

We have to notice next that the pods take upon them the colour of the earth in which they are buried ; read earths produce red pods and the first ripe pods of a crop are deeper in colour at harvest from having remained longest under ground. There is a set among cultivators and merchants alike against dark-coloured pods which makes such unwelcome. Moreover, in India seed grown on certain dark soils (" pottai-manu " soils) is rejected for sowing (Subba Rao, in *Bulletin, Dept. Land Records and Agric. Madras*, p. 263). Want of lime causes empty pods. Rich nitrogenous manures promote growth of the vegetative parts, but, so it is said, do not stimulate seed formation. Soft earth is desired for the burying of the seed, and the practice of earthing-up, done we are told as often as 4-7 times in Spain, is an aid to this end. On hard soils the pods die whenever they fail to penetrate the surface. The vigour, yield and colour of the seed are thus affected by the soil, and it is further said that an erect habit is at times produced by the soil (Watt, *Agric. Ledger*, 1893, No. 15, p. 9). The oil-contents of the seed appear to be increased or diminished according to the amount of heat available to the plant, but the statements by various writers are too contradictory to allow an unqualified statement.—*Kew Bulletin.*

TIMBERS.

THE USE OF WOOD PULP FOR PAPER-MAKING.

By S. Chas. Phillips.

It was with peculiar pleasure that I accepted the compliment you were good enough to pay me, when you invited me to read a paper on the subject of "Wood Pulp." I have been reminded of the fact that there are in this Society many members who have no practical acquaintance with paper-making or with the subject I am trying to deal with and, therefore, I hope to avoid technicalities as much as possible, although I think you will readily see it is necessary in a paper of this kind to deal in a general way with the evolution of the wood pulp industry, and particularly in its application to paper-making, and in this connection, to deal historically with the progress of pulp-making, and its chemical treatment. I think, perhaps, I need scarcely say at the outset, that in the cheaper forms of paper, as we know it to-day, the raw material is substantially wood. I am aware that if you were to ask "the man in the street" of what paper is made, you would probably be told "rags"; but although that used to be the case, the use of paper to-day is so extensive that it would be impossible to meet the demand for one-thousandth part of the total consumption, if the paper maker had to rely on rags, and I think I may here say that it is due to the engineer and to the chemist that we owe our cheap Press, and largely to the fact that wood has been taken full advantage of in its application to paper-making. For reasons which I may refer to later on, it is obvious that although England holds its own very comfortably at present as a paper-making country, it is not at all probable that Great Britain will ever produce wood for paper-making on a commercial scale. Not long ago, one of our leading paper-makers, whilst referring to this subject, observed that we might hope to make wood pulp here when we had the water falls and timber forests of Canada, Norway or Sweden. There was a great deal of truth in that remark, and although there are gentlemen who are sanguine that we might make very much more use of our forests and unproductive land than we do, that we might turn it to good account for timber growing, I do not think that for practical purposes we need, at the present moment, take that into consideration. We may (and I am speaking from practical knowledge) dismiss Great Britain out of the calculation when we are dealing with the great countries which are providing us with timber for the production of wood pulp, and are likely to do so for very many years to come. It may, I think, be said, roughly, that the wood-pulp industry has established itself and attained its present position during the past quarter of a century. There was a time within my own recollection when the manufacturers of high grade papers in this country looked askance at wood, and I know of a gentleman in the wood-pulp business who told me that about twenty years ago when he waited upon a well known Maidstone firm, and tried to induce them to give a trial to good chemical wood-pulp, the owner of the mill was very rude to him, and almost ordered him away from the place. But times have changed since then, and at the present moment many of the mills which in the early days of wood pulp derided its possibilities would not hesitate to place a very large order for the same, at what they might consider a reasonable price. To those who are uninitiated in what I may term the elementary details of the wood pulp industry, it may be necessary to mention that for the purposes of a paper of this kind, we must bear in mind that there are, to put the matter broadly, two methods of transforming raw wood into pulp.

I have, I may say, travelled a great deal in the principal pulp-producing countries, particularly Sweden, Norway, Finland, the United States, and Canada,

visiting the most up-to-date mills where all classes of wood pulp are made, and so have had excellent opportunities for studying and comparing the various processes now in use. Sweden and Norway are countries from which we have for years derived our principal supply of wood fibre for paper making. Years of practical experience have taught the Scandinavians to produce the best wood pulp in both mechanical and chemical varieties; but although both Sweden and Norway claim to have enormous forests of pulp wood, yet in spite of the law in Sweden which compels the replanting of six saplings for every tree cut down, it seems to me that at the rate at which the forests are being denuded of their timber for other purposes besides the conversion into wood pulp, in less than twenty five years from now the maintenance of the timber supply will become a grave question. While in South Germany timber fit for pulping can be grown in fourteen or fifteen years, in Scandinavia it takes about forty years.

During the past dozen years our great Dependency in the Western Hemisphere, viz., the Dominion of Canada—of which our distinguished Chairman, Lord Strathcona and Mount Royal, is the representative in this country—has come forward as a pulp-producing country, much to the relief and satifaction of British paper-makers; for, with the growth of Canadian competition, it has become an important factor in keeping the prices of pulp from Sweden and Norway from being advanced higher than was justified in normal times. So that the advent of Canada into the wood pulp business is likely to have a steadying influence in the matter of prices. I am pleased to say that Canada is making great progress in the industry by the construction of new mills, and the extension and improvement of existing mills. Our Chairman (Lord Strathcona) takes a keen interest in the wood pulp industry of Canada, and has been largely instrumental in its delelompent. As a frequent visitor to Canada, I trust that the Canadian Government will not be long before it adopts the replanting system of Sweden and Germany. At present there is but little attempt to protect the colossal and magnificent forests of the great Dominion of Canada, which are the envy of the whole world. What with the enormous wastage that goes on, and the serious inroads made by forest fires and indiscriminate cutting, Canada will have to take speedy steps to take care of the magnificent and great wealth which Nature has endowed her with in her forests, or otherwise she will, long before the present century closes, be bereft of that grand birthright.

In an essay published by Reaumur in the eighteenth century there is a suggestion that it might be possible to make paper from wood, and in 1750 paper was made from the bark, leaves, and wood of various trees in France. The class of wood generally used for the manufacture of chemical pulp is known as soft wood, and belongs to the order Coniferae or cone-bearing trees. The common spruce and the silver fir are the chief species that supply the chemical pulp of Europe, while the white spruce, black spruce, Canadian Hemlock, white American pine, and the silver fir furnish the bulk of wood pulp in America. For mechanical wood pulp poplar, aspen, spruce, and fir are mostly used. Although almost every class of wood can be converted into pulp, only the soft coniferous trees are economically, suitable. Trees having a diameter of from 6 inches to 20 inches at the base, and of about twenty years growth are considered best. Smaller are not so economically worked, and larger timber is usually cut for lumber. Within the last few years a great number of pulp mills have been started in the Southern and Western States of America, and other parts of the world, which, in order to utilise the particular class of wood growing in those districts have adopted somewhat special methods, and we now find wood pulp being produced from a great variety of woods. The great majority of pulp mills obtain their supply of wood in the form of round logs about to 10 feet long, while many in the lumber cutting districts use edgings and other waste wood from saw mills.

Sawdust has also been experimented with for the purpose of producing chemical fibre, but owing to the difficulties of getting the solven liquor to circulate readily through it, and other troublesome features it has been found to be impracticable. Shavings are the more suitable for converting into wood fibre, and are employed by some, although their bulkiness prevents any substantial weight being dealt with in each boiling operation. They might, however, be more conveniently used if they were first put through some form of machine similar to a hay-cutting mill, and reduced to small lengths.

Like ordinary lumber, the logs employed for pulp-making are generally cut by gangs of woodmen, who camp out in the forest during the winter months. In the early spring, when the snow and ice begin to melt, the logs are easily conveyed to the banks of the river, which, being at this time naturally swollen carries them down to their distination. The log-driving men's duty is to keep them off the banks, and clear of obstacles, until they reach the saw or pulp mill, where booms, consisting of a number of logs chained together endwise, are stretched across the river to prevent them from being drifted any further. By this means millions of feet of logs are annually brought from the centre of the forests down to the mills. The result of being in the snow and water, and the friction in driving, is such that the logs generally arrive at the mill with the bark entirely removed.

In Europe, Scandinavia, Russia, Austria, and Germany possess the largest wood pulp forests, which, in the former countries, are the natural virgin growth, and still very extensive, in spite of the enormous quantity cut. In Germany the original natural forests have been almost exhausted, but owing to the wisdom and foresight of the authorities, they have been replanted and grown under Government supervision. Undoubtedly the American Continent has the largest supply of pulp wood, but even the extensive forests of the Adirondacks and similar districts round the large paper-making centres are rapidly becoming depleted by the pulp manufacturers. The State of Maine and other New England States have still enormous quantities of uncut pulp wood, but unless measures are taken to preserve and cultivate them, the present rate of cutting cannot be indefinitely continued. The immense virgin forests of pulp wood in Canada and Newfoundland are practically untouched at present, but the day is not far distant when great demands will be made upon these forests.

Pulp wood is generally bought by measurement; the fact that the amount of water contained in the wood varies so considerably prevents any method of dealing with it by weight. The method of measuring timber is also very trouble. some and unsatisfactory, more especially by the tape or quarter-girt system. Measuring in fathom frames is costly work, and, like pile measurement, varies according to the skill or otherwise of those piling the logs. In America, wood is generally bought by the cord, which equals 128 cubic feet pile measurement. In Great Britain and Scandinavia it is usually bought by the fathom, which is a cubic pile of logs 6 feet long, and piled 6 feet high, containing 216 cubic feet. In many of the Continental countries it is purchased and sold at so much per cubic metre.

The appellation, wood pulp, includes two distinct varieties having different chemical compositions and properties. These are known in commerce as mechanical or ground wood pulp, and chemical wood fibre or wood celulose. The former is simply wood ground, washed, and made into layers or sheets; while the latter, or chemical wood pulp, is produced by treating the wood with various chemicals to remove the ligneous and mineral compounds, leaving the soft, pliable cellulose fibres almost pure. Of the chemical pulps, there are also several varieties, named

according to the chemical solvent employed in the manufacture—we have sulphite wood fibre, soda fibre, and sulphate fibre, or pulp prepared by the action of sulphate of lime, caustic soda, and a solution of sulphates of soda, respectively.

WOOD-STUFF, OR MECHANICAL WOOD PULP.

Dr. Joseph Bersch, a well known authority, describes mechanical wood pulp as wood converted be purely mechanical means into a fine fibred mass, which by itself may serve for the production of coarser grades of pasteboards as well as for the manufacture of various articles. Its chief use, however, is an addition to paper stock for the manufacture of inferior grades of paper. Although wood stuff, if properly prepared is sufficiently fine-fibred to be made into paper in the paper machine, it is not used by itself for this purpose, because such paper possesses the undesirable property of becoming darker and acquiring, in a short time, a brown colouration when stored exposed to the light. The cause of this phenomenon is, in Dr. Berschs's opinion, found in the fact that the wook stuff still contains nearly the entire quantity of encrusting substance—lignin, etc.,—originally present in the wood, these substance being subject to great changes. Hence, in the course of time efforts were made to remove these substances from the wood, so that only pure cellulose remains behind, which, as it does not show the already mentioned defects can be used practically by itself for the manufacture of paper.

WOOD FOR GRINDING.

Although practically every kind wood may be made use of and put into the grinder, some woods are far preferable to others, and of the European varieties of the wood, ash, linden, fir, pine, and birch are particularly suited for the purpose; whilst beech may be used, but is considerably less suitable.

In 1844 there was patented in Germany a machine for grinding wood for the manufacture of pulp. The inventor. Keller, sold the patent to the firm of Henry Voelter's Sons, who afterwards used the pulp in the manufacture of "news" paper. The Voelters made numerous improvements in Keller's invention, and a quarter of a century after it was patented in Germany by Keller, this wood-pulp machine was destined to play an important part in the United States, when, in response to the demand for the rapid printing of daily newspapers, the web press was to come into use. The Voelters—Christian and Henry—made numerous improvements in the machine, Christian Voelter obtaining patents in various European countries—in France even as early as April 11th, 1847. Henry Voelter patented his improvement on the pulp machine in Wurtemburg, Germany, on August 29th, 1856, and in the United States on August 10th, 1858.

Various methods of treating wood previous to submitting it to the action of the grinders have been proposed and used. By one process the logs of wood after being cut into suitable lengths for grinding are treated by first steaming them, then removing the acids generated in the steaming operation, next treating the steamed wood with alkali, and, finally, grinding or reducing the pieces to pulp. Steaming has been resorted to for the purpose of removing the bark from wooden blocks preparatory to grinding the solid parts; and wood has also been treated with water sprinkled on it from above, and steam simultaneously applied from beneath it, in order to soften and cleanse it preparatory to grinding.

But the process which we shall now describe, which is that of Mr. George F. Cushman, of Barnet, Vermont, is intended to facilitate the disintegration of the fibres, when submitted to the action of the revolving stones by a preliminary cooking of the block of wood in a bath of boiling hot water with lime, soda-ash, or equivalent chemical agent in solution, to soften the block, toughen the fibres, and lessen their lateral adhesion. By this process the block is reduced to pulp with much less power

than is required to grind a block not so treated; and the pulp produced is claimed to be softer, stronger, and more desirable since the fibres are not broken up or comminuted, but are more nearly in their natural condition, with their lateral beards or filaments preserved, so that when re-united in the paper sheet special toughness and tenacity are attained.

In carrying out this method, I believe it is usual to immerse the solid wooden blocks in a strong solution of lime, soda-ash, chloride of lime, or equivalent chemical agent, kept boiling hot by the introduction of steam or otherwise, and adapted to soften the blocks in readiness for grinding, and retain the blocks under treatment from ten to twenty four hours, or until the liquid has had time to penetrate all parts of the block, and the lateral adhesion of the fibres is so weakened that they will readily separate by the attrition of the grinding stone without being broken short or reduced to a mere powder; and as the chemical action is most rapid in the direction of the length of the fibres, it is desirable to cut the block much shorter than is usual, or to form transverse saw-scarfs at intervals between its ends, in order that the solution may readily penetrate from each end to the centre, so as to loosen and toughen the fibres throughout the block. The pressure of steam above the liquid in the tank tends to force the solution into all the pores of the immersed blocks; then remove the blocks from the tank and subject them to the action of the grinders in the usual way, keeping a constant stream of water upon the stone, and the disintegration will be found to be effected with great rapidity, owing to the preliminary treatment received by the blocks, and also that no washing is required beyond what results from wetting down the stone. The pulp produced is claimed to be of superior quality, and as the blocks have absorbed only so much of the chemicals as is beneficial to the fibre, it is in condition for the successive steps in the production of various grade of paper of special strength, and for numerous other purposes in the arts. If preferred, however, this fibre may be mixed with hard stock made of other material, such mixture producing paper or board of exceptional toughness.

VOELTER'S MACHINE FOR CUTTING OR GRINDING WOOD AND REDUCING IT TO PULP.

The art of reducing wood to pulp by subjecting the same to the action of a revolving stone is not a new one, machinery for grinding wood while a current of water was applied to the stone having been patented in France by Christian Voelter as early as 1847 (see "Brevets d'Invention vol. X., second series), and in England by A. A. Brooman, of London, in 1853 (see "Repertory of Patented Inventions," for May, 1854, p. 410). A large number ofinventions for cutting or grinding wood into pulp have been patented; but the enormous develepment of the papermaking industry, and the cheapening of paper during the last fifteen years are largely due to the general ntroduction of the machine for disintegrating blocks of wood and assorting the fibres so obtained into classes according to their different degrees of fineness, invented by Mr. Henry Voelter, of Heidenheim, Wurtemberg, Germany, and for which invention he received letters patent on August 10th, 1853, from the United States.

In all the processes known or used prior to Voelter's invention the wood had been acted upon by the stone in one or two ways, viz., either by causing the surface of the stone to act upon the ends of the fibres, the surface of the stone moving substantially in a plane perpendicular to the fibres of the wood; or, secondly, by acting upon the fibres in such a direction that they were severed diagonally, the surface of the stone moving diagonally across the fibres. The first plan, in fact, made powder of the wood—an obviously unsatisfactory result. The pulp had no practical length, and on trial proved worthless, or nearly so. The second plan was carried out by the use of a stone revolving like an ordinary grind-stone, the wood being applied upon the cylindrical surface thereof, the fibres perpendicular, or nearly so, to planes passing through the axis of the stone and the point or locality where the grinding

was performed; and this plan also failed, because the fibres were cut off in lines diagonal to their own length, and were consequently too short to make good pulp. There were other difficulties attending the process not necessary here to mention. Such was the state of the art prior to Voelter's invention; and his improvement in the art consists in grinding or milling away in detail from the bundles of fibres which make up a piece of wood by acting upon them by a grinding surface which moves substantially across the fibres and in the same plane with them. In carrying out this improvement upon the art Voelter splits a log of wood and applies the flat side upon the stone, and then the stone so revolves as to cause points upon its surface to pass the fibres in lines perpendicular, or nearly so, to the length of the fibre, By this mode of proocedure it is possible to obtain a sufficiently long fibre and save much power. Voelter's improvement in the art consists, further, in re-grinding the fibres by causing them, after being separated from the block, to pass under other blocks of wood, which are being reduced to pulp, upon the same stone. The fibres torn out at the first operation are thus rolled over and crushed again and separated into smaller fibre.

Voelter's improvement in the machinery are in an arrangenent of pockets, with reference to the grinding surface, so as to hold the blocks of wood in such a position that their fibres may be separated from the blocks in the manner described, and whereby fibres may be reground, and in a contrivance for feeding up the blocks by a positive feed instead of by force derived from weights or springs, as formerly practised; and a contrivance for causing the feed to cease automaticaily.

BACHET-MACHARD PROCESS OF DISINTEGRATING WOOD.

Messrs. Iwan Koechlin & Co. have carried on the Bachet-Machard Patent at the Isle Saint Martin, near Chatel (Vosges), France, and it has also been experimented with on a large scale at Bex and at St. Typhon, Switzerland. At the start the inventors had in view the saccharification of wood, the paper pulp being intended to be only a secondary product of the manufacture of alcohol; but in practise the inverse result has been obtained, the paper pulp becoming the principal product, and alcohol the secondary one.

The wood, previously sawn in thin discs, was thrown into tubs, the filling of which was then completed with water and sulphuric acid, the latter in the proportion one-tenth. Each tub would contain 188 cubic feet; eighteen hours boiling was needed: the discs were then washed as well as possible in order to eliminate the acid, then passed through the crushers and the mills. Each 31 1·3 cubic feet produced about 330lbs. of dry pulp; 65 lbs. of acid and 136 lbs. of coal were used for the production of 220 lbs. of pulp. Calculating the value of the wood at 38 cent per cubic foot, the cost of production of 220 lbs, of pulp would be 8s.

With the Bachet-Machard method a brown pulp is obtained producing a good brown folding paper costing about 3s. 6d. per 100 lbs. dry pulp. This brown is easily transformed by a half bleaching into a blond pulp costing about 8s. 4d. per 100 lbs., and this can be utilised with or without mixing, for the manufacture of wrapping paper and of all the coloured papers. Up to the present time a method for economically transforming this into white pulp had not been found (1. "Dictionnaire de Chimie," Wurtz, tome II., p. 749, et seq.)

The inventors think that the tenth of acid, which they cause to react at 212F upon the wood, saccharifies the ligneous, or rather the incrustating substance without touching the cellulose fibres; thus the cellulose becomes easily separated into fibres by mechanical means. It is probable that the acids modify the incrustating substance and render it friable, and at the same time certain principles of the wood are converted into glucose. The process is the same as with straw and esparto,

when alkaline washes are used; but it requires more energetic boiling; the proportion of alkali is doubled, and the boiling done at a pressure of 165 lbs. A little chlorine is also required for the bleaching. In this country common "news" requires to have about 20% of sulphite to hold it together on a fast-running machine. In America it can be produced with 100% mechanical, the reason being that mechanical coming direct from the gardens has greater felting powers than if converted into pulp and shiped to this country. This point is a matter of considerable economical importance, and probably accounts for the difference got with fast-running machine between England and the United States of America.

I have explained that mechanical or ground wood pulp can only be used alone for inferior grades of paper, and must be used direct from the grinders on to the paper machines. A combination of about 70-80% of mechanical wood pulp fibre, and 20-30% of chemical produce the "news" on which our daily newspapers are printed. The manufacture of wood pulp is undoubtedly a most interesting study which has closely occupied the minds of eminent scientists and experts for years, and new facts are being brought to light. Indeed, wood pulp as a field of research, seems inexhaustible. Quite recently I visited the important paper and pulp mills of the Munksjö Company at Jönköping, in Sweden, where the manufacture of what is termed "Kraft" paper was discovered, tradition says by accident, although Mr. Hagborg says that the method was arrived at after long and careful experiment. Wood pulp is used solely in the production of many thousands of tons of boards, which are used by book binders, paper box makers, and others. I might mention that in the various pulp-producing countries many millions of pounds sterling are invested in the production of pulp. A large proportion of this is British capital. Reverting to the question of

GROUND WOOD,

or, as it is generally known in this country, mechanical, it may be said that the method of logging and of conveying the cut timber from the place where it falls into the mill, is governed largely by local conditions which I shall deal with subsequently. But when once the wood is at the mill, the method of transforming it into mechanical wood pulp is today a simple one. The blocks of wood are put into a barking machine, a common form of which is provided with three knives upon a rapidly revoling drum. The blocks of wood are brought in contact with these knives and it is essential that the bark is thoroughly cleared away, otherwise the pulp will show dark spots. Knotty wood is also objectionable, and as far as practicable, knots have to be removed, and in many mills this is achieved by means of a revolving auger or a spoon-shaped auger. The wood is cut into blocks by circular saws, and it should be finally split in order that the inside of the wood may be examined, as it is undesirable that any decayed timber shall be made use of. Only sound wood should properly be used, as the effect of rotten wood is sure to be detrimental to the pulp. The actual grinding of the wood is simple. Every kind of machine for grinding consists of a grind stone (of sand stone), which runs at a very rapid rate, and against the surface of which the wood is pressed, the latter being kept constantly wet by a copious water supply. The wood is fed into what are termed pockets, and placed so that its vascular bundles lie parallel to the surface of the grindstone. The latter, in revolving, tears from the wood individual vascular bundles, and occasionally large splinters. The mass is carried by the water into a vat, in which the revolving stone is placed, and from there to the sorting contrivances, by which various sized particles of wood are separated from each other. In some modern grinders, the stone is fixed to a vertical shaft, but most authorities consider a horizontal position preferable. If time permitted, I would like to have described in detail the various types of machine in use in various countries, of which the principal ones are: Volter's, Oser's, Toith's, Freitag's, Abadie's and others. In this connection it is highly essential

that the water used shall be pure and free from suspended solid bodies, sand or clay being particularly objectionable, as they cling to the pulp and affect it considerably when it gets into the paper maker's hands. It is, therefore of course, highly necessary that in establishing the sites for a pulp-making centre, there shall be a suitable water supply, otherwise the water used for grinding must be carefully filtered, and in some mills where the water is not all that could be desired the water, after it has passed through the sorting screens, is collected, filtered, and again used.

SORTING PULP,

which follows the grinding, is a very important detail. The sorter is, in fact, a kind of sieve or series of sieves, and Voith's shaking sieve is probably one of the best types in use. The frame rests on steel springs, and the cranked axle, by an ingenious arrangement, secures uniform running, whilst the sieves jerk and shake rapidly, 400-500 motions per minute. The application of springs reduces the wear and tear very materially, and also minimises the noise. The particles of brown wood, having thus been mechanically sorted, the pulp is conducted to the settling vats, the dehydrating apparatus, or the board machines, as may be desired. There are various processes for dealing with the particles of wood which do not pass through the sieve, and, generally speaking, it may be said that they are reground and again passed through a fine meshed sieve.

The removal of water from pulp is a very important element, which has to be taken into consideration, especially where the question of freight has to be considered; and as a considerable quantity of pulp has to be shipped over large distances, it is obvious that it is not desirable to carry more water in the pulp than circumstances necessitate. Therefore, the importance of this is a matter which has a considerable bearing on the immediate advantage which accrues to a mill in the position of making up its paper from pulp on the spot, but the full consideration of this subject is a matter which is rather outside the scope of this paper. There are many forms of drying apparatus, and the preparation of perfectly dry pulp is now quite practicable. As bearing upon the importance of selecting wood of the right class for the particular purpose intended, I may here observe that Prof. Winkler made interesting experiments with pulp from different varieties of wood, which were exposed to the action of the air at a temperature of between 30° to 50° F., and he obtained most interesting results, which are fully set out on page 42 of Bersch's book.

To those of my audience who desire to go thoroughly into the chemistry of paper-making, I can recommend a publication on this subject by R. G. Griffin and A. D. Little, published by Howard, Lockwood & Co., New York. From memory, I believe the book I refer to was published in 1894. It contains a mass of information of a very useful character. Other valuable books to those who desire to go into the matter of wood pulp thoroughly are:—"Vegetable Physiology" (Goodale), also Schubert's "Die Cellulosefabrikation," and amongst our British authorities, the writings of Mr. Clayton Beadle, Messrs. Cross and Bevan, Dr. Stevens, and Mr. R. W. Sindall are amongst the most instructive; whilst the lectures delivered before this Society not very long ago by my friend, Mr. Julius Hubner, of the Manchester Technological School, also afford much information on the subject of paper making generally, and on the treatment of wood pulp from the paper-maker's point of view.

CRUSHING.

Another interesting process in the preparation of mechanical wood pulp was known as the crushing process, and the effect is the preparation of pulp from steamed wood without the necessity of grinding. This has been known as the Rasch-Kirshner method. The steamed wood was first converted into small pieces by means of a chopping machine of special design, and then the wood was cut by a knife mechanically driven lengthways into shavings of fixed size, or lengthways as well as cross-

ways. The small pieces of wood were then fur her reduced by mechanical means, having first been subjected to the action of a stamping mill, and eventually were put into the Hollander, and I am told that a very decent class of brown boards or stout wrapping papers could be made in this way, and it is stated that boards and paper especially suitable for roofing purposes made by this process had special advantages. Some of such boards, impregnated with coal tar, were said to be specially adapted for resisting the action of the weather, and are described as "perfectly indifferent to water as well as to changes of temperature." Attempts have been made to bleach the pulp made from steamed wood, but so far as I can learn the results were not commercially successful.

Although it may possibly, strictly speaking, be somewhat beyond the natural scope of a brief paper of this kind to go into the commercial details of wood pulp making as regards cost, I have been favoured by a gentleman who is in a special position to obtain information of this kind with some very interesting figures. I am told that it requires.

Although it may possibly, strictly speaking, be somewhat beyond the nature and scope of a brief paper of this kind to go into the commercial details of wood pulp-making as regards cost, I have been favoured by a gentleman who is in a special position to obtain information of this kind with some very interesting figures. I am told that it requires 80 h.-p., to make one short dry ton per day, or say 90 h.-p., to make one long dry ton per day, so that a mill developing 1,800 h.-p., on the turbines should produce 20 tons of dry mechanical pulp per day, or say, 12,000 tons per year of 300 working days. Some Norwegian mills have very small horse power on the stones, but the latest and the most modern mills have at leat 250 h.-p., whilst the Canadian mills are calculated on a basis of 300-350 h.-p., per stone, and very large stones are used. On the subject of the actual cost of producing mechanical pulp, I am told that a pretty reliable estimate of the cost of the wood necessary to make a ton of dry pulp is approximately :—

Dry Pulp.

In East Norway	from	25s.	to	30s.
In North Sweden	,,	22s.	to	25s.
Canada : Lake St. John and portions of Nova Scotia	,,	13s. 6d.	to	15s.
St. Maurice River and other districts	,,	15s.	to	22s.

Wet Pulp.

The net cost, allowing for depreciation, is given approximately as follows :—

	Per Ton Dry Weight.		
	£	s.	d.
Modern Mills in Norway, C/a	3	0	0
,, ,, in Sweeden, C/a...	2	15	0
Lake St. John	1	17	6
St. Maurice District	2	10	0

On this subject, it should be borne in mind that the capitalisation of a modern pulp mill is very high. and for a mill making, say, in Scandinavia 6,000 tons wet, and 3,000 tons dry, f.o.b. value (roughly) £10,800, the mill capitalisation would necessarily be from £20,000 to £25,000; and hence it follows that to make ten per cent on the capital a net profit on the produce of from 20 to 25 per cent is necessary.

Small mills such as these form the majority in Scandinavia; but mills of this class could not be made to pay in Canada, where the biggest mill (Chicoutimi) made 48,000 tons of short wet pulp in six months. The entire capitalisation on this basis is 27 dols. per short ton dry per annum, or say, £6 5s. per ton dry wet (2,240 lbs per year), making the value of a short dry ton to be 13·50 dols. f.o.b. On this basis, a good return will be shown, *viz.*, a net profit of 20 per cent on the article yielding ten per cent for the purposes of dividend.

In the matter of general cost of good bleaching pulp, of course, local conditions here, as in the case of mechanical pulp, have a considerable influence; but I am told that good bleaching pulp may be produced at a cost net (including everything, with the exception of interest and depreciation) at about the following figures. In Norway, at modern mills, about £6 per ton at the mill; unbleaching qualities would probably cost about 10s. per ton less. In Sweden the cost varies considerably, but about £5 may be stated for "news" pulp, and £5 10s. for bleaching; and this is, I think, a low estimate and can only be applied where the most favourable conditions are in operation. So far, practically, no success has attended the Canadian pulp mills in the manufacture of chemical pulp, and this I attribute largely to lack of knowledge of the technicality of sulphite-making, and through the lack of organisation as to timber supply. Mills have been put down where timber could be had before building for 2·50 dols. to 3 dols. per cord in limited quantities, but owing to lack of organisation and adequate security for the continuty of supply, prices have been forced up in Canada to 5 and 6 and even 7 dols. per cord, which is higher than in Scandinavia. On the subject of capitalisation, a modern mill would be doing well if capitalised so that every £5 of capital produced one long dry ton per year; but most mills are, I think, capitalised on a great deal higher basis than this, and the fact is, of course, obvious. This, however, is much better than mechanical making, as ten per cent net on the article will nearly always give more than enough for a ten, per cent dividend.—(*Extracted from the Journal of the Society of Arts, Vol. LIII.*)

(*To be Continued.*)

HORTICULTURE.

GARDEN ACCESSORIES: THEIR POSSIBILITIES IN COUNTRY AND CITY GARDENS.

It gives me pleasure to meet you to-day for the purpose of discussing with you some features of ornamental gardening, such as fountains, pools, pergolas, arbors, trellises, bowers, terraces, walls, balustrades, summer-houses, or garden-houses, benches, urns, tables, and figures. You will pardon me if I take advantage of the chance the stereoptican offers me to monopolize most of the discussion. While treating with garden accessoriess I wish to point out the opportunity for their use in city-yard-gardens; such little formal gardens as might easily be made out of the typical unsightly back-yard; but I will first speak of these features in connection with the ornamentation of larger gardens. When I was asked by the lecture committee to give a talk on this subject of garden accessories, or garden ornaments, or garden furniture, as you may choose to call it, I thought it would be more interesting and more instructive to treat the subject in a general way rather than to talk about each particular style of garden ornament by itself; for the reason that the successful use of these features in a garden or on the grounds of a country place must depend not only upon the design of the accessories themselves but upon the *positions* they occupy. The most beautiful arbor, pergola, summer-house, or fountain may look ugly if it is not appropriately placed so as to appear in keeping with its surroundings. The introduction of such garden accessories as these together with terraces, pools, walls, sundials, tables, and the like has been made possible by the ever increasing use of our gardens and home grounds as out-of-door living rooms.

The great wave of "garden magic" that is sweeping over us and is being so enthusiastically encouraged by many magazines and writers of to-day is awakening in us the fact that we ought to make more use of our gardens apart from the pleasure of gathering and caring for flowers; and we ought to make them look attractive by the introduction of features that will give charm when there are no flowers in bloom, as is always the case in this climate six or seven months out of the year. There is more to gardening than the mere raising of flowers. If any person does not think so he had much better raise his flowers as he would vegetables, in simple beds by themselves, rather than make a feeble attempt to dress up his grounds with fantastically arranged flower beds. And this same principle holds true in regard to the employment of garden accessories. Better make no attempt to use them at all, if it cannot be done more artistically than we sometimes see in some country places which have been absolutely ruined by spotting them with hideous statues and flimsy iron fountains and the like; but such cases are comparatively rare.

One of the most useful of garden accessories and one that looks appropriate in almost any garden is a summer-house, or garden-house, or exedra, as it sometimes called in Italian gardens. No matter whether your garden is large or small, formal or naturalistic, there is generally a cosy spot where a summer-house would fit nicely. The intense heat of our summer sun in New England almost necessitates such a shady retreat where one may sit and enjoy the beauty of the surroundings. I daresay all of you can recall many gardens beautiful enough in themselves but decidedly unliveable because of this hot sun.

The summer-house need not be a pretentious affair unless the grounds around it are rigidly formal. Some of the most charming ones are made of red cedar with the bark left on, or of rough oak, roofed with stout beams and thatched with straw

or pine needles. I have in mind two such simple structures, illustrations of which I will now show you. This one I had the interesting experience of constructing unaided on my place in Belmont, and I think I learned more about carpentering during the time it was being erected than I could have in years of study in theory. Surely if bruised hands and hammered thumbs count for anything I accomplished great things. This summer-house is unique because it is thatched with pine needles. This thatch is a simple one to make and was suggested to me by the falling of the dead needles from the pine trees under which the summer-house is built. The roof was first covered with heavy tarred roofing paper and upon this was spread a thick coating of coal-tar. While the tar was still warm, brown pine needles were spread on by the bushel basket full and the whole was raked smooth until the needles lay quite flat. The house is absolutely rain-proof, and the yearly supply of dead needles from the trees over head makes up for the loss of those that decay in the process of weathering. Of course, it is an ideal structure for vine and climbers, and these help its appearance by giving it an air of repose and dignity. When we consider the many uses that a summer-house may afford we wonder that there are not more of them.

Other accessories that give a shady retreat in a garden are pergolas, arbors, trellises, and bowers. These might all be classed as cousins in the garden family, or even closer relations, so much do they resemble one another, both in form and purpose, namely; the covering of pathways with vines and greenery, letting in just enough light and air to produce comfort, and to make vistas through the glimmering light and shade. Flowering vines never appear to better advantage than when trained on the posts and cross-beams of a pergola, making an airy tunnel of greenery and bright color.

But the raising of vines and climbers is not alone excuse enough for building a pergola. Such a structure should lead to something, to a garden seat or a summer-house, or it should connect one part of a garden with another. The pergola may be an elaborate affair of stone columns supporting heavy oak beams, interlaced overhead like those in Italy, or it may be made entirely of wood with simple upright posts and cross-beams with the bark left on. Many of the attractive arbors of lattice work seen in some of our old Colonial gardens are modified pergolas, and they are often used for the purpose of raising grapes.

Another feature that is not introduced enough in our gardens and one that always produces a magical effect when properly used, is water as a fountain, or in a simple pool where one may raise water plants. The very sound and appearance of water in a garden produces a cooling effect, and aside from the enjoyment derived from the musical splashing of a little fountain, the reflection of sky and flowers will give a charm to a garden never to be forgotten.

The only objections that I have ever heard to this kind of garden accessory are that it is expensive to supply the water, and that mosquitoes will breed in these miniature ponds. As for the cost of supplying water, I know this to be very small even in the city of Boston, for I had a fountain and pool constructed for the Garden Studio last summer and the charge is but ten dollars a year for a continuous supply through three-eighth inch jet. One need not fear of mosquitoes breeding if there are a few fish in the water, for it is well known that mosquito larvæ will be eaten by them as fast as the mosquitoes' eggs are hatched. The most serviceable material for building fountains and water basins is composition stone, made of cement, and it produces a simple and artistic effect that is vastly different from the hideous appearance of most of the iron work of this nature. I venture to say that many of our gardens have not enough of the air of seclusion which is generally so necessary for the successful introduction of fountains or pools. It is the restful kind of garden surrounded by hedges or trees that invites this sort of accessory.

The garden seat is an accessory that should be welcome in any garden. How transient many gardens seem because of the absence of a convenient bench that would invite one to take time enough to enjoy the surroundings. There is hardly a limit to the number of designs suitable for garden seats and benches, and yet how homely is the stereotype affair we so often see in parks and public gardens. Now that composition stone has become so useful for making garden ornaments, there is not much difficulty in finding graceful seats and benches that will last forever. Good ones can be bought for about twenty dollars. Some of the more elaborate seats are covered to keep out the sunlight, and to give a chance for climbers to grow upon them. Many of these are quite large so that they have the appearance of small summer-houses.

The much discussed Italian garden is dependent upon such accessories as walls and terraces and steps, but this form of gardening is often misunderstood by people who try to fit it into locations where it is absolutely uncalled for; and the term Italian garden is applied by the unthinking to any kind of garden that has in the least degree a formal layout. Of course it is on the hill side that this sort of garden is built in Italy. A flat situation calls for a different treatment, and, although walls are often used with success in level gardens, they are walls that are quite different from the heavy retaining-wall of the Italian garden; they are used more as one would use a hedge. Walls and terraces are to a garden what the walls of a house are to its interior. Their excuse for being should be for support or giving an air of privacy and protection. I think you will agree that such gardens have a charm quite distinct from all others.

Other accessories that serve a useful purpose and are much admired for their ornamental qualities are well curbs, urns and pots, tables, sundials, gazing-globes, and figures. I have seen many little gardens where one of these decorative pieces served as a keynote to the entire situation, around which paths and flower beds were arranged in such a manner as to make an agreeable picture of the whole. At the intersection of paths, at the end of a walk or pergola, or in front of a garden-house are some of the situations where these pieces may be placed so as to give one the impression that they *must* be where they are or else the garden would lose much of its charm. The relation that these smaller garden ornaments bear to their surroundings must be as carefully studied as the placing of the larger accessories. I should like to take up in detail each of these smaller accessories but the time alloted for this lecture is not sufficient. However, I want to call your attention to the great possibilities in this field of garden accessories as applied to the city back-yards. These yards, as they exist for the most part in the homes of our well-to-do-people, are a disgrace to the community. Neat, some of them may be, but what ugliness is to be seen when one looks out of a dining-room window and sees an assortment of clothes and clothes-lines, ash-barrels, garbage-boxes and the like, all up down the line.

Let us hope that the ever increasing regard for our gardens as places that should give comfort and beauty combined will lead to a fuller appreciation of the proper use of garden accessories.

[*Transactions of the Massachusetts Horticultural Society for the year 1906, Part. I.*]

PLANT SANITATION.

ON THE IMPORTATION OF BENEFICIAL INSECTS FROM ONE COUNTRY TO ANOTHER.

There are many large groups of insects which are parasitic in their habits and which destroy other insects. There are other large groups which are predatory in their habits and feed upon other insects. There is hardly an injurious insect which does not have its natural enemies in its own class. Sometimes the natural enemies will have the upper hand and the injurious species will be greatly reduced in numbers. Again the natural enemies will be reduced and the injurious species will abound. Wherever an injurious insect exists under normal conditions and in its original home, its natural enemies as a rule keep it in check and prevent its unlimited multiplication. But now with the large scale expansion of agriculture and horticulture, and with the constantly increasing rapidity of traffic between countries, it has frequently happened that injurious insects have been introduced from one country to another without their natural enemies, and have consequently multiplied to an enormous degree. The United States has suffered especially from accidentally introduced insect pests mainly coming from Europe. About one-half of the injurious insects of first-class importance now existing in the United States were accidentally introduced from some foreign country.

A great interest in the handling of insects by means of their natural enemies has constantly been increasing in many parts of the world since the year 1888 when the strikingly successful search for the natural enemies of the fluted scale (*Icerya purchasi*) was begun under the auspices of the United States Department of Agriculture. But the idea was an old one. Dr Asa Fitch, formerly the State Entomologist of New York, was probably the first entomologist in America or elsewhere to take this question into serious consideration. In 1854, following a disastrous attack upon the wheat crop of the eastern United States by the wheat midge (*Diplosis tritici*), a species accidentally introduced from Europe during the early part of that century, Doctor Fitch made a careful study of the insect both in this country and from the European records, and was impressed with the fact that in Europe the insect in ordinary seasons did no damage, and that when occasionally it became so multiplied as to attract notice it was a transitory evil which subsided soon. He compared the insects taken from wheat in flower in France with those taken from wheat in flower in New York, and he found that in France the wheat midge consisted of but seven per cent of the insects thus taken while its parasites consisted of eighty-five per cent; whereas in New York the wheat midge formed fifty-nine per cent of the insects captured and there were no parasites of which he could be certain. He then came to the conclusion that it was a question of introducing the parasites into the United States, and he made an effort by correspondence with English entomologists, which however was a failure owing to the fact that he was unable to enlist the active co-operation of his correspondents.

Later William LeBaron, State Entomologist of Illinois, attempted to transport a parasite of the oyster-shell bark-louse of the apple from one part of the State of Illinois to another part of the same State where the parasities seemed to be lacking. Some slight success was reported, but the parasite subsequently proved to be one of general American distribution. Another international attempt was made in 1873, when Planchon and Riley introduced an American predatory mite into France. The mite was an enemy of the grapevine Phylloxera, and became established in France, but produced no appreciable results in the way of checking the pest. In 1874

efforts were made to send certain parasites of plant lice from England to New Zealand but without recorded results of value. In 1880, in an article in the Annual Report of the Department of Agriculture for that year, the speaker showed that the transportation of scale-insect parasites is especially easy and especially desirable. In 1883 Prof. C. V. Riley imported a common European parasite (*Apanteles glomeratus*) of the imported cabbage worm from England into the United States. It has since established itself in this country and is a valuable aid in cabbage culture.

All previous experiments were completely overshadowed by the remarkable results of the importation of *Novius (Vedalia) cardinalis* a lady bird, from Australia into California in 1889. For three years beginning with 1886, Professor Riley, then Entomologist of the Department of Agriculture, had recommended to the authorities in Washington that an effort be made to study the natural enemies of the scale in Australia and to introduce them into California, since he had determined by correspondence that Australia was the original home of the species and that on that contintent the scale was not especially injurious. California fruit growers petitioned Congress to the same effect. Finally, during the winter of 1887-88, the Secretary of State, at the request of the Commissioner of Agriculture and of Professor Riley and of Mr. Frank McCoppin, of California, Commissioner-General to the Melbourne Exposition, appropriated funds for this purpose; and an assistant in the Division of Entomology, Mr. Albert Koeble, was sent to Australia on the Melbourne Exposition fund. He found the famous lady bird, *Vedalia cardinalis*, in North Adelaide, and made several sendings to southern California where the insects were cared for by another assistant in the division of Entomology, U.S. Department of Agriculture, Mr. D. W. Coquillet. In less than a year, on Californian soil, the lady bird had multiplied so extensively as to practically destroy the fluted scale and to reduce it to a condition where it was no longer a factor in the cultivation of oranges and lemons. The same insect was later introduced from California into New Zealand and into Portugal and into Egypt, with similar striking results. In 1893 Mr Koeble resigned from the Department of Agriculture and was employed by the State Board of Horticulture of California to proceed again to Australia and other points in a general search for beneficial insects. He made extensive trips and imported a number of beneficial insects into California, one of which, a ladybird known as *Rhizobius ventralis*, proved to be of value in reducing the numbers of the black scale in such portions of California as were near the sea, notably in the large olive plantations owned by Mr. Ellwood Cooper, of Santa Barbara. Hundreds of thousands of the beetles were distributed in California, and in some localities kept the black scale in check. Away from the moist coast regions, however, it proved to be less effective.

Subsequently the speaker introduced from Italy a curious little Chalcidid parasite known as *Scutellista cyanea*, and endeavoured to acclimatize the species in Lousiana upon the wax scale. The parasites however, died out. Later other specimens of the same parasite were sent to the speaker from South Africa by Mr. C. P. Lounsbury with the statement that it is there a parasite of the black scale. With Mr. Lounsbury's help, South African specimens were introduced into California and there colonized by Mr. E. M. Ehrhorn, Horticultural Inspector for Santa Barbara County, and Mr. Alexander Craw, Quarantine Officer of the State Board of Horticulture. The first successful introduction occured in 1900, and during the following years it was constantly distributed in California and by the close of 1903 many orchards had been practically freed from the black scale, and the good work still continues.

After Mr. Koebele's second oriental trip he resigned his position in California and was employed by the newly established Hawaiian Republic for the purpose of

travelling and collecting beneficial insects to be introduced into Hawaii. He has since continued his work under that Government and has imported many insects, some of which are said to have accomplished good results. For example, a ladybird known as *Coccinetta repanda* was brought by him from Australia and China and is said to have exterminated plant-lice on sugar cane and other crops. Another ladybird, *Cryptotaemus montrouzieri* is said to have destroyed the scale insects on coffee plants and other trees; while a Chalcidid parasite known as *Chalcis obscurata* introduced from China and Japan, is reported to have multiplied enormously at the expense of an injurious caterpillar which had attacked banana and palm trees.

The San José scale, while attacked by various internal parasites proved in the Eastern United States to thrive in spite of their presence, and in 1901 and 1902 Mr. C. L. Marlatt, Assistant Chief of the Division of Entomology of the Department of Agriculture, made a trip of exploration in oriental countries, lasting more than a year. He found the original home of the San José scale to be North of China, where its original host plant is a little haw apple which grows wild over the hills. He found there everywhere a ladybird known as *Chilocorus similis*, feeding in all stages upon the San José scale. Specimens of these were shipped to Washington and bred freely, afterwards being sent in colonies to various parts of the United States. The colonies at Washington were practically exterminated the second year by an American parasite of ladybird beetles, and among the Colonies sent out those in the North did not succeed in establishing themselves. In the South, however, the species increased and is still maintaining itself although the universal use of the lime, sulphur, and salt washes has prevented it from becoming an important feature in the insect fauna of that region.

After Mr. Koebele left California to go to Hawaii, Mr. George Compere was sent by the State Board of Horticulture of California to make investigations and to send to California such beneficial insects as he deemed of probable value. Later he entered the employment of the Government of Western Australia, and has since been travelling in various parts of the world, partly in the interest of Western Australia and partly in the interest of the State of California. Several species have been discovered by him and sent to California, all of them being desirable additions to the California fauna, although the last reports from the Commissioner of Horticulture do not indicate that any of them have as yet done work of any great value. Mr. Compere's latest importation into California is a European Ichneumon fly known as *Calliephialtes messor*, a species which occurs commonly throughout Europe and which has been recorded as an European enemy of the wax moth (*Galteria metlonetla*). This parasite was found in Spain feeding upon the codling moth larvæ, and he imported specimens into California. It is said to have already established itself there and to promise good results. Mr. Compere has also imported several beneficial insects into Western Australia, the one which he thinks will accomplish the best results being a parasite of the so-called fruit fly (*Ceratitis capitata*) which he found in Brazil,

The speaker described his visit of the previous summer to Europe to originate an extensive effort to import the European parasites of the gypsy moth and the brown-tail moth into Massachusetts and to acclimatize them in that State. He showed that both of these insects are well known in Europe and are by no means as injurious on that continent as they prove to be in Massachusetts. They are known to have many natural enemies and parasites in Europe. Fifty-two species of parasites have been recorded for the gypsy moth by European entomologists, and nearly the same number for the brown-tail moth. The speaker visited Europe during June and July, 1905 and secured the sending from Italy,

Australia, parts of Germany and Switzerland large numbers of parasitized full-grown larvæ and pupae of the gypsy moth to Boston. From these specimens were reared six distinct species of parasites, and of these about 500 puparia of *Tachina larvarum*, one of the largest and most important of the European parasites, were secured and kept for overwintering in an apparently healthy condition. Numerous specimens of a smaller Tachina fly were also secured. The other parasites from these particular sendings were unimportant. Arrangements were made in Europe with a large number of experienced collectors and with the official entomologists of different countries, so that the work of sending parasitized specimens over to America will be continued systematically for two years to come. The work of 1905 has shown that it is an easy matter to import these parasites in living condition, and, with the abundance of food which they will find in Massachusetts, there can be little doubt that they will establish themselves and will rapidly increase, eventually bring ing about the the same condition of natural equilibrium that exists in Europe.

The assistance and co-operation of official European entomologists were readily gained, both on account of their general interest in such matters and of the fact that the United States can be of use to their countries in a similar way. Thus already, the speaker stated, he had shipped sendings of *Diaspis pentogona* and *Mytilaspis citricola* to official entomologists in Italy and France in the hope that American parasites of these species will issue on European soil.*

It will appear from what has been said that some excellent results have been obtained in this introduction work. Very many experiments have resulted negatively, and many of the insects imported have not proved to be of great success but every natural enemy of an injurious species, once established, is more or less of a help in the warfare against the pest. When a great success is achieved like that of the introduction of the Australian ladybrid or the African Scutellista, the saving which results far more than compensates for the expenses of long continued travel and investigation.

Finally, it must be stated that in experimental work of this kind, when conducted by the right men, there is no danger. The historic cases of the introduction of the English sparrow into the United States, of the East Indian mongoos into the West Indies, and of the European rabbit into Australia, are often mentioned in connection with these importations of beneficial insects and as warnings. But parasitic insects are always parasitic upon other insects and nearly always upon injurious species. Predatory insects are always predatory upon other insects. There is not the slightest danger that any of these importations will become destructive to agriculture except in the indirect way in which a secondary parasite, by destroying a primary parasite, may thus liberate an injurious insect from attack. Persons engaged in this work, therefore, should be able readily to distinguish between primary parasites and hyperparasites.

Referring in conclusion to the importation of the natural enemies of the gypsy moth and brown-tail moth, the speaker stated that the prospects on the whole are favorable for eventual relief. He stated, however, that this relief will not be speedy, and property holders in the infested regions must not relax their efforts to keep the injurious insects down. Observations during the past years have shown that the complete defoliation which results from the attacks of the insects will kill certain varieties of trees in two seasons, and if work against the insects is remitted while waiting for the parasites to develop, the consequent loss will be very great.

* During the winter of 1905-06, 116,000 nests of the browntail-moth were brought over from many different localities in Europe. These were installed in the laboratory at Saugus, and at the date of writing over 40,000 primary parasites have issued and are being colonized in the vicinity of Boston. L.O.H. May 31, 1906.

DISCUSSION.

At the conclusion of Dr. Howard's address the Chairman stated that opportunity was offered for any questions on the subject.

Mr. James H. Bowditch said that he would like to ask the lecturer if he would not advise the acceptance, as a matter of additional precaution, of the offer of Hon. Ellwood Cooper of California, who guarantees to introduce effective parasites for the sum of $25,000, to be paid only when the work is a proven success.

Dr. Howard replied that he had a good opinion of Mr. Cooper and that the work in California in the line of introduction of parasitic insects had in some instances been successful, but if the work in Massachusetts should prove a success how should we know when both were working in the same field, whether his parasites or those of the U. S. Department of Agriculture were producing the better results? And, therefore, how would the State know whether to pay Mr. Cooper the remuneration mentioned?

Mr. Bowditch replied that it did not make any difference to us, the sufferers, whose parasites they were, provided we got rid of the pests. Mr. Cooper proposes to employ George Compere, who has just been favorably spoken of by Dr. Howard, to work with him. When a man is critically ill a consultation of doctors is both proper and desirable, and that is the condition in which we now find ourselves in relation to this great trouble that come upon our woodlands and orchards. He said he should be sorry and disappointed if Mr. Cooper refused to work with Dr. Howard. Mr. Bowditch stated that he had consulted the Attorney General of the State to learn if it were possible to have the $25,000 set aside for this purpose out of the remaining unexpended balance of the general state appropriation of $300,000, and was informed that the question should properly come from Superintendent Kirkland, who has promised to make the enquiry. He had also received a letter from W. D. Sohier, Esq., who was of the opinion that the better way would be to engage Mr. Cooper by private subscription, and to this Mr. Bowditch agreed. There was no doubt that the amount required could be raised easily and he could see no objection to the business men of Massachusetts taking up the matter and employing Mr. Cooper to perform this work. There had been received already an offer from an Ex-President of this Society, Mr. Nathaniel T. Kidder, to be one of five to contribute $5,000 each under proper conditions, for this purpose. He said that he certainly hoped that Dr. Howard and Mr. Cooper would join forces, and that we ought not to neglect any plan that seems to offer additional prospect of permanent relief.

[*Transactions of the Massachusetts Horticultural Society, for the year 1906, Part 1.*]

MISCELLANEOUS.

Some Hints for Village Agriculturists.

By M. Wijayanayaka.

Since the Ceylon Agricultural Society has undertaken to appoint a number of Agricultural Instructors I beg to commend the following hints to those who are really interested in the welfare of the agricultural classes, so that all concerned may be able to make the best use of the privileges offered by the Society.

1. An Instructor can do very little without the co-operation of the headmen, who are really responsible to see to the welfare of the poor.

2. In all probability there will be only one Instructor in charge of a Province, who will be stationed in the chief town of the Province.

3. It is necessary that the chief town of each Province is made the centre of the work which is carried out in the Province under the auspices of the parent Society of Colombo.

4. Each and every chief town should have a Society to which are affiliated all the minor societies of the Province. There should be a minor Society in the division of each chief headman who should be the head of the same.

5. When the societies are formed steps may be taken to open up experimental farms in the vicinity of the chief towns, under the supervision of the Instructor, and minor farms in other divisions under the immediate supervision of the chief headmen.

6. At the meetings of the different societies the Instructor could explain personally to the villagers the different methods adopted to make the soil give the largest possible quantity of vegetable produce, for the use of man and domesticated animals, at the least expense and labour and with the least injury to the soil. Further, he could instruct on the new products that are being daily introduced to the country by the Society; and in the farms he could give practical demonstrations on the same instructions and the use of the proper implements of Agriculture.

I beg to conclude my remarks with the following extract from Sir J. Sinclair:—"It is both the duty and interest of every owner and cultivator of the soil to study the best means of rendering that soil subservient to his own and the general wants of the community; and he who introduces, beneficially, a new and useful seed, plant, or shrub into his district, is a blessing and an honour to his country."

CO-OPERATIVE SAVINGS AND CREDIT SOCIETIES IN CANADA.

Co-operative savings and credit societies in Canada, owe their existence to the altruistic purpose and able initiative of Mr. Alphonse Desjardins, a resident of the city of Lévis, Quebec, and one of the officials of the House of Commons, Ottawa. For over ten years Mr. Desjardins has been a careful student of co-operation, and has watched with interest the progress of the co-operative movement in England, France, Germany, Italy, Belgium, Austria and other countries. One form of co-operation, in particular, has appealed strongly to him, impressed as he has been with the need of encouraging thrift amongst his fellow-townsmen and countrymen, and of finding for the financially feeble some means of effectively supplying the need of personal credit, where merit and circumstances alike warrant and opportunity alone is lacking. The form is spoken of as co-operative credit.

This form of co-operation has found expression in the several countries of Europe in credit societies and people's banks, extending to the number of several hundred and even thousands. In France Les Banques Populaires and Les Caisses Rurales, as they are called, number over 2,000. In Germany they are 12,000 and more, co-operative credit societies and loan banks. In Italy the Banche Popolare (Banques Populaires), the Casse Rurale (Caisses Rurales) and the "Catholic" banks, number over 2,500; in Belgium over 300; and in Austria nearly 5,000. In Russia the number of similar institutions is over 5,500. In England the people's banks and co-operative credit societies are also numerous and have been increasing yearly in number.

All these institutions have this in common; they aim through the encouragement of thrift to create a capital out of the savings of persons of very limited means, which capital may be profitably invested and opportunity thereby afforded such persons of securing advances and loans at reasonable rates, where otherwise loans might be obtainable only at usurious rates, or not obtainable at all.

ORIGIN OF THE LEVIS SOCIETY.

Mr. Desjardins undertook, in 1900, to establish among the people of his own locality a co-operative savings and credit society, or people's bank. In September of that year he brought together at his residence a dozen of his fellow-townsmen whom he had interested in the project, and carefully outlined his plan. During the course of the following three months they drafted a constitution, subscribed a number of shares at $5 a share, which were subsequently paid in instalments, and established what they designed as "La Caisse populaire de Lévis"—a co-operative savings and credit association, with a variable capital and limited liability. As members of this co-operative society they had henceforth the right to share in the direction of its affairs, participate in its profits, and on complying with its requirements to obtain credit in limited amounts.

On December 6, 1900, the number of shareholders of La Caisse Populaire de Lévis was 100, and the number of shares subscribed, 500. The institution grew steadily in favour and in the confidence of the people on whose behalf it had been established. In a year the number of shareholders more than doubled. By December, 1902, the number was 450. At the begining of the present year (January, 1905) the list of shareholders included over 900 names, representing over 5,500 shares.

OBJECTS OF THE LEVIS SOCIETY.

The objects of the savings and credit society are more far reaching and important than is suggested by the name, though its objects are disclosed in part therein. Broadly speaking, they may be said to be in their nature, moral, economic and educational, in that, supreme among its purposes, is the encouragement of thrift and the promotion of honesty and honour, the furtherance of selfreliance and economic independence; and the fostering of an appreciation of business principles and a practical knowledge of business relations. In a general way, the society also aims at serving the industrial needs of the community in which it is established, by providing a means to less fortunate members of carrying on work or enterprises which but for its assistance could not be undertaken.

The several objects are set forth in detail in the constitution of "La Caisse Populaire de Lewis." Stating, precisely and concisely as they do, the objects of this particular and similar institutions, they may be quoted at length.

The objects of the association are:—

1. To protect its members against reverses of fortune, the results of enforced idleness, sickness and want, by teaching them the inappreciable benefits of wise providential measures based on mutual assistance and co-operation, and, in particular, by instilling and developing in them the taste for and the constant and energetic practise of economy even on the most modest scale;

2. To aid them by a wise and prudent system of credit in the shape of loans and advances, the proposed employment whereof must be communicated to th association, be approved by it, and be in accordance with the spirit in which it is founded;

3. To enable persons devoid of fortune but who are industrious, honest and laborious, to form part of the association by granting them facilities for paying up their shares in the capital stock by means of very small weekly instalments;

4. To secure the practice of the Christian and social virtues that mark the good citizen, the honest, the laborious and honourable worker, by exacting above all moral warranties of highest order from the shareholders who borrow from the association;

5. To combat usury by means of co-operation and mutual assistance by providing all who are deserving of the same, through their fondness for work, their skill and the integrity of their conduct, with the moneys they require for carrying on their business or occupation, and which they cannot obtain from existing financial institutions owing to the insufficiency of the present system; thereby making them independent of lenders who levy exhorbitant commission or interest, or of those who impose too onerous conditions in connection with credit;

6. To foster the spirit of enterprise and promote local works, whether of an industrial or agricultural character, by the prudent use of the savings effected with in the district covered by the association's operations;

7. To spread amongst its members a practical knowledge of the elementary principles of economic science and to teach them respect for their engagements established by their signatures, as also the advantages inevitably derived by those who faithfully fulfil the obligations they have undertaken;

8. To create and foster mutual confidence between shareholders by means of economic relations based on the security of warranties of a high character, in as much as they are founded in a very great measure, on morality, honesty, order, love of work and prudence;

9. To gradually procure them—by persevering efforts towards securing economy and consequently a just measure of credit—that economic independence which inspires and fosters the feelings of personal diginity and convinces one of the need of relying above all upon oneself to improve one's position and raise oneself in the social scale.

OPERATIONS OF THE LEVIS SOCIETY.

The objects of the society are sufficient to indicate the nature of its primary functions. In the first place it encourages savings by the formation of a capital made up of shares which are small in amount payable in weekly or monthly instalments, and on the basis of which the division of the year's profits is made. Secondly, it receives from its members deposits of any amount of not less than 5 cents, on which interest is allowed; and, thirdly, it grants loans, makes discounts and advances to members on their own signature and the personal security of other members of the society. The society is restricted in its operations to doing business with its members only, and the membership is restricted to a certain area.

SHARES AND SHAREHOLDING.

To become a shareholder and thereby a member of the society, persons desiring to become such must be accepted by the society in the first instance. Applications for allotment of stock are required to be submitted to a council of administration appointed at a general meeting of members of the society, which council may require every application to be seconded by two shareholders. Every shareholder must be reputed as of good habits, sober and punctual in payments. Either men

or women may become shareholders, but female shareholders are not allowed to hold office. Shareholders are liable for the debts of the society only to the amout of their shares, and each share entitles the holder to a proportion of the yearly profits. The shares are of the value of $5. each, and amounts may be paid in weekly or monthly instalments, and until the full amount of the share has been paid off, the holder is not entitled to participate in profits. A fee of 10 cents is charged as an entrance tax on each share subscribed for.

Any shareholder may cease to belong to the society and withdraw the instalments he has paid on the shares subscribed by him by giving a written notice of thirty days to the council of administration, and a member may be expelled if he becomes bankrupt or insolvent or his property is liquidated judicially because of refusal to pay his debts, or failure punctually to fulfil obligations he has undertaken towards the society or has in other ways attempted to abuse the privileges of the society or deceive its officers. Instalments paid by a shareholder up to his explusion are repaid him, minus the interest for the current year and entrance fees. The quality of shareholding is forfeited by resignation, by death, explusion, or for any cause which would have prevented a shareholder's admission to the society.

DEPOSITS.

Savings deposits of as small an amount as 5 cents may be made, and may be received, repayable on demand, or after notice, at a specified date. Interest on savings deposits of all kind is fixed by the council of administration, which has authority to adopt special measures in connection with savings deposits and deposits payable at a specified date, by allowing a higher rate of interest on the latter, according to the length of the period at which they are repayable. Every shareholder making a deposit is given a pass-book. The rate of interest on the savings deposits is fixed by the board of management and is posted up in the office. It is paid and capitalized at the end of each year. The society receives deposits to afford facilities to its shareholders for the payment of their rent, contributions to mutual benefit societies, life and fire insurance premiums, &c., which deposits are repayable only at the date specified by the shareholder in opening his account.

LOANS AND ADVANCES.

The society may make loans or advances on simple notes or acknowledge, ments, but only such loans and advances as can yield a profit or a saving for the beneficiary are allowed. All applications for loans or advances are forwarded to the manager, who is obliged to submit the applications to a committee on credit and management, which committee decides whether the application is to be granted or refused, and all decisions of the committee with regard to applications must be adopted unanimously. Members of this committee are not allowed to borrow from the society nor become security for any loan or advance. In the event of a refusal by the committee on credit and management to grant a loan or advance, the interested shareholder may appeal to the council of administration, who, after hearing the members of the committee as well as the shareholder, give their decision according to the majority of the votes. The council of administration determines the rate of commision and interest to be charged, as well as the duration of loans and advances. Small loans and advances are always to receive preference over large ones, when the security for repayment is equal.

It is generally agreed that the repayment of loans and advances shall be by instalments which are as far as possible, of equal amounts and are payable weekly, fortnightly or otherwise as agreed upon. These instalments as paid are entered as deposits which bear interest at the rate provided; or as instalments are paid in, the interest charged on the loan is reduced in proportion to the amount of the loan paid

up. For example, a man borrowing $100 for five months, repayable in monthly instalments of $20 each, will receive interest on the first instalment paid in for four months, on the second instalment for three months, &c., in each case the instalment paid in on account of loan being treated as if it were a new deposit. Or supposing the loan to have been made subject to the right of repayment in two instalments, at any or specified dates, the interest on part of the loan to the extent of the amount covered by the instalment would terminate with its payment, and the interest of the balance with the payment of the second instalment.

As a rule, the loans and advances are secured by the signature of two solvent sureties who must be shareholders, but in addition to these signatures the committee of credit and management is obliged to inquire carefully into the personal financial standing and condition of the borrower, and ascertain whether reasonable confidence may be placed in his promptness to repay the loan. Above all, they are obliged to obtain accurate information with regard to the honour, the spirit of order, activity, honesty and ability of the borrower, and the latter is always bound to state in his application for credit the use he intends to make of the moneys asked for. The society may open credits on current accounts, with or without security, but the amount due is not at any time allowed to exceed $100.

Administration and Management.

The affairs and management of the society are under the direction of a council of administration, a committee of credit and management and a committee of supervision, whose powers and action are determined by the shareholders as a whole, in general meeting assembled.

To preserve the democratic nature of the institution, and to further successfully its main objects, two principles have been regarded throughout as fundamental. In the first place, the number of shares to be acquired by any one person is limited by the general meeting of shareholders, and in the second place, in the management and direction of affairs, the votes have been on the basis of membership rather than on the basis of the number of shares held—one associate, one vote. In this way the controlling interest of all the members has been made dominant over an otherwise possible cumulative interest of a few. Another fundamental principle is the local control, no branch system being admitted.

The General Meeting.

A general meeting of shareholders is held annually, and where occasion demands, extraordinary general meetings may be called. At the general meeting the officers of the society and the members of the various committees are elected. No shareholder is allowed more than one vote, whatever may be the number of shares he owns, and no one can vote unless he has been a shareholder for at least three months, and is in good standing with the association. Decisions are adopted by the majority of the votes. The general meeting receives the reports of the council of administration and the committees of credit and management and the committee of supervision, which reports it examines, approves or rejects. It determines, subject to the provisions of the by-laws of the society, the dividends to be paid, and the maximum of advance to be given to a single shareholder.

The Council of Administration.

The council of administration consists of nine members chosen from amongst the shareholders by the general meeting. Its members are known as directors, and are elected for three years, three members retiring at the expiration of each year.

The council thus elected chooses a president, vice-president and secretary, who are likewise the president, vice-president, and secretary of the society. This

council meets at least twice a month and as often as may be necessary in the interest of the society. Its powers are most extensive, including the admission and refusal of admission of shareholders, the expulsion of members, the filling of vacancies in the council and the several committees, the appointment and removal of employees, together with the fixation of their duties, salaries &c., ; the making of agreements and regulating of transfers and withdrawal of shares, the making out of balance sheets and dividends to be paid, the manner in which moneys, reserve, provident and other funds are to be employed, and generally, the taking of all measures that may be deemed advisable in the interests of the society. They also appoint and remove the manager of the society and determine the expense of management. They may borrow money on the credit of the society from one or more shareholders to meet applications for loans and advances when the available funds are insufficient. To the same end they may rediscount securities on hand, though their power to borrow for this purpose is restricted to $300, except by special authorization from the general meeting of shareholders, and their power to rediscount, to $500, without the same authorization. They determine the rate of interest to be allowed on savings deposits and the conditions connected with the calculation and payment thereof ; also fix the rate of commission and interest on loans and advances, and determine the duration of the latter and of conditions respecting renewals.

The members of the council of the society incur no personal or joint liability in connection with the operations of the society. They are responsible solely for the execution of their duties.

THE MANAGER.

The management is entrusted to a salaried official called the manager, who represents the society, under the immediate supervision of the council of administration. He has full control over the staff and proposes the appointment or suspension and dismissal of employees to the council of administration, who decide finally. The manager, under the superintendence of the committee of credit and management draws up daily, weekly, monthly, or yearly, statements of the society, and submits a general report of its operations, the statements show the position of affairs from the beginning of the year to date, and are placed at the disposal of the shareholders by being posted in the office or otherwise. The manager, moreover, makes an inventory at the end of each fiscal year, and this, with a report showing the exact position of the society's affairs communicated to the annual meeting.

THE COMMITTEE OF CREDIT MANAGEMENT.

Tho president and other shareholders chosen for the purpose at the general meeting, constitute a committee of credit and management, the shareholders so appointed not being allowed to belong to the council of administration or to another committee. Their term of office is two years, one half retiring each year. No transaction in connection with the loan or advances can be made by the society without the previous approval of the committee of credit and management, and its decision must be unanimously adopted by the members present—the presence of three members, at least, being required to render decisions valid. They cannot borrow from the society. Should their decision not be unanimous in any matter, it is brought before the council of the society, whose decision is final.

The services of the officers and various members comprising the council of administration, the committee of credit and management and the committee of supervision, who are charged with the administration of the operations of the society are gratuitous. They are, however, entitled to travelling expenses when necessary, as well as expenses necessitated by the performance of special duties entrusted to them.

THE COMMITTEE OF SUPERVISION.

The general meeting selects yearly from amongst the shareholders, three members who constitute a committee of supervision. This committee watches over all the operations of the society and frequently checks the cash, investments and securities; sees to the carrying out of the bylaws and regulations and decisions of the committee of credit and direction, especially as regards loans, renewals and advances. They must ascertain frequently and at least once a month, the exact value of the securities in hand, and have the right to examine and audit all the books of the society. Where urgency demands it, they have power to suspend officers and to call a general meeting of the shareholders.

The members of this committee must be chosen from amongst the shareholders, other than those who are upon other committees, and are not allowed to borrow from the society. They must meet at least once every month and draw up a minute of their checking and auditing and submit a written report to every annual general meeting.

FUNDS AND RESOURCES OF THE SOCIETY.

In carrying on its business the society has, by way of funds and resources :—

(1) The entrance fees paid by each shareholder, which amounts to 10 cents per share ;

(2) The capital represented by the shares subscribed and paid up by the shareholders (shares being of the value of $5 each) ;

(3) The reserve fund, the provident fund, and such other funds as may be established ;

(4) Instalments paid on shares not yet fully paid ;

(5) The moneys at any time deposited by shareholders, and the resources obtained by temporary loans or by rediscounts.

A reserve fund is established to secure the soundness of the institution, and to have ample security for deposists made, This fund is made up from

(1) The entrance fee of ten cents on each share ;

(2) An assessment of 25 per cent of the net profits of the year until the fund amounts to at least double the maximum obtained by the paid up capital at any time.

(3) The interest on investments effected with the resources pertaining to such fund ;

(4) The amounts received from the subsequent payment of debts written off as loss on a previous year's account. This fund so established remains the exclusive property of the society which is obliged by its constitution not to adopt any decision calculated to weaken the fund so established. The resources of this fund are laid out and invested at the discretion of the council of administration to the best advantage for the interests of the society. As it is established chiefly for the securing of deposits and for assuring a proper working of the society, it is affected only by extraordinary losses extending beyond other resources at the disposal of the society.

A provident fund is established to cover extraordinary losses resulting from the operations of the society. It is constituted by means of an assessment of 5 per cent. on the net profits of the year until the fund is equal to at least one-half of the paid up capital.

Speculation by the society in stocks and all hazardous operations are forma ly prohibited.

PROFITS.

After providing for all the costs of management and for losses, the net yearly profits are divided as follows :—

(1) Twenty-five (25) per cent. to the reserve fund; (subject to previous provision.)

(2) Five (5) per cent. to the provident fund.

(3) Five (5) per cent to local benevolent or charitable works.

(4) Four (4) per cent. in the discretion of the council of administration as additional remuneration to the salaried employees of the association as a reward for good conduct in the performance of their duties.

The balance is divided amongst the shareholders in proportion to the period and amount of paid up shares. This amount is not to exceed 8 per cent. until the reserve fund reaches double the maximum attained by the capital at any time.

FINANCIAL SITUATION OF LEVIS SOCIETY.

To show the practical working and financial conditon of "La Caisse Populaire de Lévis," a statement may be given of the situation of this institution as it stood on February 14 of the present year. On that date the amount of paid up subscribed capital was $24,584·62; the amount of savings deposits, $5,529·70; amount of interest still to be paid on savings unpaid, $34·81; amount of dividends unpaid, $408·20, making in all a total of $30,557·33. The amount paid as entrance fees on shares subscribed from December 1 to February 14, 1905, amounted to $40·90. The reserve fund amounted to $1,306·76, the provident fund to $130·05, these together with a surplus of $236·42, making a grand total in addition to the capital of $1,714·13 for the protection of deposits etc.,

The profits from December 1, 1904, to February 14, 1905, amounted to $296·09. The grand total of liabilities on February 14 was, therefore, $32,567·55

Of the assets of the society there were loans to the amount of $25,631·18, general expenses $15·50, cash in hand $6,920·87, the whole making a grand total of $32,567·55.

As shown in the monthly statement of the manager of the society these amounts appear as follows :—

FINANCIAL STATEMENT OF THE "CAISSE POPULAIRE DE LEVIS" ON FEBRUARY 14, 1905.

Assets.

Loans		$25,631·18
General expenses		15·50
Cash on hand		6,920·87
		32,567·55

LIABILITIES.

Paid up capital		$24,584·62
Deposits		5,529·70
Interest upon deposits		34·81
Dividends (unpaid)...		408·20
Total liabilities ...		30,557·33
Entrance fees	$40·90	
Reserve fund	1,306·76	
Provident fund	130·05	
Surplus	236·42	
		1,714·13
Profits		296·09
		32,567·55

Certified correct,

Lévis, February 15th, 1905.

(Signed) ALPHONSE DESJARDINS,
President Manager.

BUSINESS DONE BY LEVIS SOCIETY.

The following figures will show the amount of business done by the society from the time of its establishment in December, 1900, up to February 14th, 1905. The total amount received on account of capital subscribed has amounted to $29,943·10. Comparing this amount with the total amount of paid up capital on hand on February 14th, it would appear that since the commencement of the society, $5,538·48 has been reimbursed to shareholders who for different reasons desired to withdraw their shares. The total amount paid on account of entrance fees (being 10 cents per share on shares subscribed) was $693·90, which would indicate that in all 6,939 shares have been subscribed. The total amount received in profits on account of loans, etc., has been $3,326·50. This amount, added to the amount on account of entrance fees, makes a total of $4,020·40, which total has been divided as follows :—

To the reserve fund	$1,306·76
To the provident fund	130·05
On account of surplus	236·42
As interest on deposits	240·01
On dividends distributed among shareholders	1,598·02
On account of general expenses	187·65
Amounts not as yet appropriated	321·49

The total amount received on account of deposits, from the establishment of the society up to February 14th, was $12,257·27, out of which the sum of $6,727·57 has been reimbursed to the depositors, leaving the amount on account of deposits at the present time $5,529·70. Since the inception of the society to February 14th, 1905, a total of $104,554·94 has been loaned, of which the borrowers have repaid $78,923·56, leaving a balance of loans outstanding of $25,631·18. Taking a general survey of the entire business of the society from its establishment it appears that the society has handled funds amounting in all to $125,144·33.

Set forth in statistical form, as represented in the semi-monthly statement of the manager of the society, these amounts appear as follows :—

FINANCIAL STATEMENT OF BUSINESS OF "LA CAISSE POPULAIRE DE LEVIS," FROM JANUARY 23, 1901, TO FEBRUARY 14, 1905.

RECEIPTS.

Paid-up capital		$29,943·10
Entrance fees	693·90	
Profits	3,326·50	
		4,020·40
These two last amounts being divided as follows :—		
Reserve fund	$1,306·76	
Provident fund	130·05	
Surplus	236·42	
Interest on deposits	240·01	
Dividends	1,598·02	
General expenses	187·65	
Unappropriated amounts	321·49	
	4,020·40	
Savings deposits		12,257·27
Loans repaid		78,923·56
		125,144·33

DISBURSEMENTS.

Withdrawals of shares	...	...	$5,358·48
do on deposits	...	...	6,727·52
Loans	...	...	104,554·94
Interest on deposits	...	...	205·20
Dividends ...	...	...	1,189·82
General expenses...	...	...	187·65
Cash on hand ...	...	...	6,920·87
			125,144·33

Certified correct,

Levis, February 15th, 1905.

(Signed) ALPHONSE DESJARDINS,

President Manager.

BENEFITS DERIVED BY SHAREHOLDERS AND COMMUNITY.

Mr. Desjardins, the president and manager of the society, states that the great majority of the share-holders of "La Caisse Populaire de Levis," are working men, most of whom hold two or three shares each. Nearly 700 different loans have been made since the establishment of the society, to about 100 different borrowers, in sums varying in amounts from $1 to $500, the majority averaging from $50 to $100. Most of the loans have been made for a period of four months, and have been to small traders, mechanics, farmers, and others, to enable them to make advantageous purchases, to tide over temporary difficulties and to meet pressing demands. Of all the loans made not a single borrower has failed to make payments of the amounts advanced.

It is, so Mr. Desjardins states, the general consensus of opinion of the shareholders that but for the establishment of this savings and credit society not $2,000 out of the $32,500 which has been deposited in the bank in the form of shares and deposits would have been saved. Among the shareholders are many young men who are apprentices or mechanics and who commenced with taking only one share, and have at the present time as much as $200 laid aside in the form of paid-up shares or deposits. These amounts have been accumulated chiefly through the opportunity afforded of acquiring shares by the payment of small amounts in weekly or monthly instalments. Having commenced by making a weekly deposit of 10 cents, may have acquired the habit of depositing regularly with the bank and have shown a disposition to increase the amount of their deposits from month to month and year to year.

Not only have the members of the society received assistance by way of advances and acquired habits of thrift from the practice of making regular deposits, but not a few have been saved from serious embarassment and from extortion at the hands of usurers. The operations of "Caisse Populaire de Levis" are restricted to the town of Levis and the parishes of St. David and St. Louis, the total population of the area being about 7,500. To serve the financial needs of this locality there are four large banks, as well as the post office savings bank.

Up to the present time the business of "La Caisse Populaire de Lévis" has, been conducted almost entirely by Mr. Desjardins himself. He has given his services gratuitously and has had the office of the society in his own residence. For the convenience of the working-classes, an office has been opened on Saturday nights in a central part of the city, at which office deposits are made by working men after the receipt by them of their weekly wages. The business of the society has grown so considerably and rapidly that the necessity of having a regular office with paid assistants is becoming more and more urgent.

Other Co-operative Societies.

After the formation of "La Caisse Populaire de Levis," a similar co-operative savings and credit society was organised at St. Joseph de Lévis, an adjoining parish. This society, which is in a rural parish, has been formed on identical lines with "La Caisse Populaire de Levis" and has at the present time about 100 shareholders. In September, 1903, a third co-operative credit society was organised at Hull, Que., also after the model of "La Caisse Populaire de Levis" it has at the present time about 80 shareholders. The last society to be formed was organised in January of the present year at St Malo in Quebec East. Notwithstanding the very short time since its establishment, this society has already a membership of over 200.—*From the Labour Gazette, issued by the Department of Labour, Canada, March, 1905.*

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Agriculture in the Phillippine Islands.

BY W. I. HUTCHINSON.

(*Delegate from the Philippine Islands to the Ceyton Rubber Exhibition.*)

The following particulars concerning the Philippine Islands may prove of interest to readers of the *Tropical Agriculturist.*

The Archipelago extends from 4° 40' to 21° 10' N. Lat. and from 116° 40' to 126° 34' E. Long. The distance from Manilla the chief town and port to Hongkong is 628 miles, to Singapore 1386, to San Francisco 6950 ; to Australia 2 weeks by steamer and to Borneo 5 to 6 days by steamer.

NUMBER OF ISLANDS.—The total number of Islands in the Archipelago is 3141, of which 1668 are named and 1473 unnamed. The total area of the Archipelago is 115,026 sq. miles ; area of the two largest islands being Luzon 40,969 sq. miles, Mindanao 36,292 sq. miles. 9 Islands have an area of over 1,000 sq, miles. 2773 have an area of less than one sq. mile.

The population of the Philippines, taken in the 1903 census showed a total of 7,635,426 ; of this number 6,987,686 are civilized and 647,740 uncivilized or wild people.

In the northern islands the wild people, for the most part are Negritos and Igerotes, while in the southern islands the wild population is largely Moro, a branch of the Malay race. The Moro population of Mindanao and the Sulu Archipelago is 370,684 while the total civilized population of the same area is only 249,685; (figures obtained in 1903).

DENSITY OF POPULATION.—The density of population for the whole Philippines is 67 to the square mile, that of the various islands is, however extremely variable as is shown by the following figures :—

Island	Density of population per sq. mile.
Paragua	3
Mindoro	7
Mindanao...	14
Luzon	93
Laguan (Samar)	839

A larger percentage of the land is undeveloped and still under forest. Many of the northern islands are largely under cultivation, the mountains however being forested. In the southern islands, Mindano etc, it is estimated that forests cover 70% of the total acre.

TIMBER AND LUMBERING.—The are between 700 and 1000 species of timber trees, a large number of which are excellent for construction timbers, furniture and cabinet work, etc., trees 3 to 5 feet in diameter and over 100 feet in height are common throughout the forests. The forest laws are liberal. Lumbermen are given concessions of from 50,000 to 200,000 acres on which they have the first right to cut timber. A small forest tax is charged for each cubic metre of wood cut. Numerous sawmills are scattered throughout the islands and lumbering is a paying business. Minor forest products, such as dyebark, firewood, gums and resins, rattan, guttapercha, are also abundant. Large quantities of gutta and "almaciga" (resin) are shipped from the Island of Mindanao to Singapore. The total area of agricultural land, at the time the census was taken (1905) was 2,827,704 hectares. This amount is only 9·5% of the total area of the islands. In the last few years agricultural development has made rapid strides of advance.

AGRICULTURAL LAND.—The following figures show the percentage of agricultural land that is land actually under cultivation, in a few of the most important islands.

Island.	Total area hectares.	percentage of agri: land.
Mindanao ...	9,399,628	1·4
Luzon ...	10,610,971	15.1
Cebu ...	456,350	26·3

An immense amount of land in all the islands is awaiting development. Large areas of bottom land formed of alluvial wash from the mountains is available for the cultivation of rubber, manila, hemp, sugarcane, coconuts, and tobacco, etc.

The chemical composition of such soils, is excellent, in fact richer than most of the best quality land in Ceylon. Planted on such situations, crops make a surprising growth.

LAND LEASES.—Much of the best land is held by the Government. Coporations may buy up to 2500 acres for approximately $2·00 gold U.S. (Rs. 6) per acre. The land may also be leased for 25 years for 25 cts U.S. gold per hectare, with an option on a renewal of the lease for another 25 years at a rate not higher than 75 cents U. S. gold per hectare.

CLIMATE.—The mean annual temperature of the Islands is 80° F. The average maximum temperature for the last twenty years was 92·5° F, with an average minimum during the same period of 69° F. The rainfall varies according to situation. The yearly average varies from 33 to 160 inches but in the planting districts rarely falls below 70 inches. The rainy season is July, August, September, October, the dry season is March, April, May, June. The seasons however, also vary according to situation. On the whole the rainfall is fairly evenly distributed throughout the year, so that there is rarely a month without at least occasional showers. The climate is excellent and Americans find no difficulty in spending a long period of years in the Islands.

FIGURES IN MORTALITY.

Americans period of 8 years	...	14·80	per thousand
Spaniards 1995	...	20·17	,, ,,
Chinos ,,	...	16·15	,, ,,
Filipinos ,,	...	44·54	,, ,,
Other Nationalities 1905	...	29·05	,, ,,

AVERAGE DEATH RATE.

Philippines period 13 years	31·7	per thousand
Ceylon	27·6	,, ,,
Japan	20·6	,, ,,
Bombay	53·0	,, ,,
Madras	22·0	,, ,,

The most important crops in the Islands at the present time are Manila hemp, sugarcane, tobacco, coconuts, rice, etc., A large quantity of these products is shipped to foreign ports each year.

COMMUNICATIONS.—The principal markets are Hongkong, Singapore, Borneo, Australia, San Francisco. Throughout the Islands there are numerous large and small streams, so that water transportation is an easy matter. Inter-island steamers, of which there are a large number, carry the various products to the main shipping centres Manila, Cebu, Ilo-Ilo, Zamboanga etc.

There are over 200 miles of railroads in the Island of Luzon at the present time and the Government has recently let a contract for the construction of 400 additional miles, to be completed in 4 years; in the Islands of Luzon, Cebu and Negros.

Manila, which has recently been declared a free transhipment port, is connected by direct steamship lines with all the large trading centres of the Orient, *e.g.*, Hongkong, Japan, Singapore, Borneo, Australia and also with San Francisco, Hawaii and Guam.

LABOUR.—The usual labour problems common to the East are met with in the Islands. Labour is fairly plentiful and of a good quality. In order to keep the workmen on a farm, however, it is necessary to construct small houses nearby and allow the man to bring his family and fighting cocks as, with these missing, a Filipino hardly considers life worth living.

WAGES.—The following is an approximate scale of wages paid in the Islands at the present time (1906.)

ISLAND OF NEGROS.—Farm-labour 50 to 75 cents U. S. gold per week with food. Lumbering operations 25 cents U. S. gold a day without food.

ISLAND OF MINDORO.—Farm-labour $5/00 gold (U.S.) a month without food. Lumbering 25 to 30 cents U. S. gold a day without food.

ISLAND OF LUZON.—Lumbering 25 to 30 cents U. S. gold a day.

ISLAND OF MINDANAO.—Farm-labour 55 to 30 cents U. S. gold a day without food. Lumbering 20 to 40 cents U. S. gold per day without food.

N. B.—Lumbering—Men engaged in felling trees and working around sawmill.

RUBBER CULTIVATION.—The cultivation of rubber has been taken up on a small scale within the past year, largely in the Island of Mindanao. Small lots of rubber were also planted in the vicinity of Manila previous to this date. Much of the land in Mindoro and Mindanao is well suited to the cultivation of Para.

Unfortunately the only planting in Mindoro was done during the hot season with disastrous results. 6,000 seedlings were set out and left without water or shade with the result that less than 100 of the number lived till the rains came.

In Mindanao, however, excellent results have been obtained by judicious planting. Many of the planters are enthusiastic on the rubber question and it is expected that rapid strides in rubber planting will be made in the next few years. With excellent land, an average rainfall of between 70 and 160 inches and a yearly average temperature of 80° F, rubber should prove a paying investment.

The following figures on rubber were recently compiled by the writer.

ISLAND OF MINDANAO P. I.

PLANTATIONS.

	Para.	Ceara.	Castilloa.	Total.
No. of plants ...	9,000 ...	3,000 ...	400 ...	12,400
Distance planted ...	15×15 ...	20×20 ...	15×15 ...	—
Area planted, acres ...	47·4 ...	27·7 ...	2·1 ...	77·2

SEEDS, ON LAND READY TO PLANT.

Number of seeds ...	32,000 ...	57,000 ...	2,500 ...	91,500
Estimate of the number of plants which will be raised from these seeds ...	15,000 ...	40,000 ...	1,800 ...	56,800
Probable distance of planting	15×15 ...	15×15 ...	15×15	
Probable area planted (acres) ...	79 ...	2,105 ...	94 ...	2,278

Estimated total area which will be planted by June 1907—380 acres.

The following figures on the rate of growth were also collected by the writer.

HEIGHT.

Para seedlings ...	3 to $5\frac{1}{2}$ feet in 9 months	(In seed bed)
,, tree ...	6 ,, 10 ,,	(plantation)
Ceara trees ...	13 ,, 17 ,,	in 7 months (plantation)

Ceara (individual tree, largest in plantation 1 year old) height 19 feet 6 inches. Diameter 3 feet above ground $6\frac{1}{4}$ inches.

Castilloa tree 6 to 8 feet in 9 months (plantation).

AMBALANGODA AGRI-HORTICULTURAL SHOW.

I have the honour to report that the following sections and classes were judged by me in the Welleboda Pattu A. H. Exhibition held on the 20th and 21st December, 1906. :—Section 1. Classes A. and B. (Cut flowers and pot plants-Fruits) Section 3. Class B (New Products) with Mr. H. F. Macmillan, Curator R.B.G. Section 2. Class A (Vegetable products Nos. 2-9) with Mr. Bowman. Section 10. Class A and D (Cultuvation of Paddy and Vegetable gardens (Special) were judged alone.

My report on the judging of paddy cultivation Section 10 Class A which was conducted just before harvest time in August has already been submitted to the Secretary, C.A.S. The judging of Class 1 in the same Section was carried out between 17th and 19th December. I do not consider that the month was a suitable one for judging standing garden crops, as such an important crop as yams is generally lifted about this time, and a good deal of land is at this season under preparation. To make conditions still more unfavourable a great deal of damage had been done to the large majority of gardens by the unusual floods a month before, from the effects of which they had hardly time to recover when I started judging, In the first division of Class D. vis, best vegetable garden by any member of the Association, 13 gardens competed, and the garden exhibited by Mr. G.B. Wickremaratna of Weragoda was awarded the Gold Medal. I would make special mention of Mr. Wickremaratna's garden not only for its extent and situation but for the methodical way in which work was carried on.

In the second division viz., best vegetable garden by a villager, 8 gardens competed and the prize was awarded to R. Nandoris Silva,

I regret to state that with the exception of a very few gardens in the first and second divisions no attempt had been made in methodical laying out or the systematic cultivation of crops. From what I could see in the majority of cases after the land was cleared, tilled, and manured and the seed sown, the crops were allowed to shift for themselves more or less, and in many instances even ordinary weeding and supporting of plants had been neglected.

In the third division 2 school gardens competed viz., Ambana and Hikkaduwa. The former was 18 miles inland and the latter quite within the reach of sea spray. Hikkaduwa School was awarded the prize, and the work carried on there was satisfactory considering the difficulties.

In section 1 Class A. the collection of wild flowers was good and well competed for, but the competition for the prize awarded for cultivated flowers was not satisfactory. Pot plants were good and fairly well grown, but the exhibits were rather mixed up and there was considerable difficulty in judging.

Class B. Fruits. This class was altogether poor in quantity as well as quality, and this was to be expected considering that it was not the season for fruits. There were however a few good oranges and pines and jack fruit. The exhibit of plantains should have been better I think.

Section 2 Class A. nos. 2-9. The competition was very good in hand made coconut oil (Aththel) as well as king coconut oil. Oil seeds, gums. resins, and native dyes were not particularly well represented.

In section 3 Class B (new products) there were two exhibits of groundnuts, three of cotton, two of Eri Cocoons. three of rubber.

All the first three were good average samples The sheet rubber exhibited by Mr. Northway, who was awarded the Gold Medal, was of excellent quality.

(Sgd.) ALEX PERERA,
2nd Assistant Supt. School Gardens.
Government Stock Garden, Colombo 18th, January, 1907.

Correspondence.

CARAVONICA COTTON.

SIR,—As you know, we have tried Caravonica cotton here, but I am sorry to say it did not thrive well in the Aurash Valley ; I suppose on account of the high altitude (800 métres), and certainly because of the cold at nights from the end of November to February (15 degrees centigrade).

The foliage was not good, the leaves becoming rolled and black. The bolls were not bigger than Egyptian cotton, and the lint not strong. We are also too far from the sea. Egyptian cotton is doing fairly well.

We have just formed our plantations into a company, with a capital of Francs 600,000; under the title Société Franco-Anglaise d'Exploitations Agricoles en Abyssinie. The subscribers are nearly all cotton brokers from Havre and Glasgow.

Yours faithfully,
A. SAVOURE.

Addis-Ababa, December 8th.

[Caravonica cotton has yet to prove that it possesses any qualities that would make it desirable to plant rather than Sea Island or Egyptian, both of which get better prices. Also it has decided disadvantages in the matter of pests, being a long-lived crop on which they can survive.—ED.]

ROZELLE.

SIR,—Last year the Superintendent of the Stock Gardens kindly gave me a few seeds of this. I have now grown a second crop out of seeds obtained from those. It is a shrub not unlike the tea with plenty of stalks. The plants have not thrived so luxuriantly nor have they borne so well as was the case with the imported seed owing perhaps to deterioration.

The seed has to be sown in a nursery, transplanted and watered in dry weather, mulching once or twice. Stable manure answers well. The fruit or rather the pod ripens in 6 months culminating in the plant itself dying out. Care should be taken to gather before setting in of the rains, which spoil the fruit in no time. A bed of a dozen plants gave me about 1½ bushels of fruit. Some jelley was made out of it, the only known use it may be put to—I mean of the bright red outer covering of the beans. I would not recommend its cultivation but for the stalks which yield a most valuable fibre. It is literally full of fibre. I send you a sample coarsely prepared as it is, as also a piece of rope made out of it.

Rozelle was long known to us as *Rata Belin*, the tender leaves being some times used for curry. I understand it is largely cultivated in Southern India for its fibre to make ropes with. Its Tamil name is *Pulichchi Naru.*

GEO. WEERAKOON.

Talangama, 6th Dec. 1906.

Ceylon Board of Agriculture.

The 28th Meeting of the Board of Agriculture was held at the Council Chamber at 12 noon on Monday the 4th February, 1907.

His Excellency the Governor presided.

The others present were:—The Hon. Messrs. H. C. Nicolle, J. Ferguson, C.M.G., Francis Beven, S. C. Obeyesekere, Messrs. J. Harward, T. J. Campbell, H. T. S. Ward, E. B. Denham, Drs. J. C. Willis, H. M. Fernando, Messrs. Solomon Dias Bandara, G. W. Sturgess, E. E. Green, Gerard Joseph, William Dunuwille Dissava, C. Drieberg, and T. A. Carey, Secretary to the Board.

BUSINESS DONE.

1. The minutes of the meeting held on Janury 7th were read and confirmed.

2. H. E. the Governor proposed, and the Hon. Mr. S. C. Obeyesekere seconded:—"That Dr. Willis be appointed Organising Vice-President, with a salary of R3000 per annum; and that Mr. C. Drieberg be appointed Secretary to the Board with a salary of R3000." Carried.

3. The report by the Second Assistant Superintendent of School Gardens on the late Show held at Ambalangoda was tabled.

4. The Progress Report (No. 27) was presented and taken as read.

5. Mr. G. W. Sturgess, G.V.S., submitted his report on castration work during 1906.

6. Mr. E. B. Denham asked, "What steps have been taken by the Committee appointed to enquire into the question of sterlization of milk?" The Secretary replied that the Committee were taking the necessary steps for making trials with apparatus shortly expected from England.

7. Mr. C. Drieberg read extracts from his official report on his recent visit to India dealing chiefly with the Calcutta Exhibition, Sericulture in India, and the possibilities of a fruit trade with Ceylon.

H. E. the President, Dr. Willis and Mr. Ferguson offered remarks on the paper read.

The meeting terminated at 1-30 p.m.

Agricultural Society Progress Report. XXVII.

New Members.—The following new members have joined the Society since the last meeting :—Messrs. A. N. Cantlay, R. Doresamy, J. R. Watson, Alfred de S Jayasundera, V. Vijeyeratnam, John Francis de Souza, C. Wallich.

Branch Societies.—Following an inaugural meeting held on the 28th December, 1906, a Branch Society has been established at *Rayigam Korale.* It is proposed to start an experimental garden in connection with this Society, where experiments will be made in the cultivation of varieties of fruit trees and vegetables new to the district. The new Society has on its roll some 97 members, and Mr. J. A. Wirasingha, Mudaliyar of the Korale, is interesting himself in the work.

The Assistant Government Agent, Kalutara, suggests the formation of Branches in the rural districts in each korale, where the main work should be the opening of experimental gardens to instruct the local farmers, who are more likely, as a class than townspeople, to take a practical interest in them. This proposal is receiving the attention of the Board as regards the financial support necessary for carrying out the project.

The *Telijjawila* Branch held a meeting on the 3rd January, when, amongst other subjects, it was discussed whether, in view of the expense of erecting sheds at Weligama for the proposed Show to be held in March next, it would not be advisable to hold the Show in the sheds already erected at Telijjawila and the money thus saved be more usefully spent. There being no railway station at Telijjawila, some of the members were of opinion that visitors may be prevented from attending. Discussion was deferred.

It was agreed at this meeting to obtain only varieties of *vegetable* seeds for which there is a local market for distribution in the 19 Vidane Arachchie's divisions among competitors at the forthcoming Show.

Transplanting in paddy cultivation.—Prizes were arranged, under the same conditions as in the Show of March, 1906, for the best results obtained in transplanting paddy. The amounts of the prizes remain the same as in previous year.

At a meeting of the *Harispattu* Agricultural Society, held on the 20th January at Alawatugoda, a storekeeper was appointed to take charge of the seed store established at Katugastota ; it was agreed to communicate with Mr. Palipane, R.M.' with a view to leasing out a piece of land adjoining Ihalagastenna school, and that the Koralas be requested to report on suitable sites for proposed experimental gardens in Kalugammanasiya pattu, Udagampaha, Pallegampaha, and Medasiya pattu.

The subject of the proposed *Show* to be held under the auspices of the Branch came up for discussion, when it was decided that the Society should take part in the Kandy Show proposed to be held in 1908. Mr, W. D. Banda read a Paper on "Home Gardens."

The Three Korales and Lower Bulatgama Branch, at its quarterly meeting held at the Ruwanwella Ambalam on the 26th January last, resolved upon leasing two acres of land from a private owner in Ruwanwella, close to the cart road, for the experimental garden, which will be planted with products new to the district and vegetables, &c. Members owing land agreed to open private gardens at their own expense.

Vavuniya Forwarding Agency.—The Vavuniya Forwarding Agency sent down a second consignment of ten black cattle and eight buffaloes on Friday, the 1st

(two truck-loads). These arrived in Colombo late in the night and were put up to public auction at the Maradana Terminus on Saturday, the 2nd, by Mr. A. Y. Daniel, Auctioneer, and fetched the following prices :—

Buffaloes.—Rs. 31, 31, 30, 30, 28, 28, 27, 25; total Rs. 230.

Black Cattle.—Rs. 34, 21, 17, 16, 16, 16, 15, 15, 13, 11: total Rs. 177. Grand total Rs. 407.

Inquiries are now being made with a view to a trial being made with agri cultural produce. The Agency can send down limes and yams of different varieties, including "the king," manioca, &c. The Agency will be glad to negociate with any local buyer for the disposal of these and other produce.

The subject of the proposed Central Agency will be further discussed at a meeting of the Sub-Committee to be convened shortly.

Agri-Horticultural Shows.—A further report on the *Wellaboda pattu* (*Galle*) Agri-Hoticultnral Show, by the Second Assistant Superintendent of School Gardens (which was not available at the last meeting), is tabled.

It was decided at a meeting of the *Trincomalee* Agricultural Society, held on the 10th January, that seeds ot egg plant, bandakka, beans, tomato, cucumber, and kohl-rabi be obtained from the Superintendent of School Gardens from stock imported by the Society, and be supplied free to such of the villagers as well grow and exhibit products at the forthcoming Market Show in April. Major Molesworth of Oopar estate, Trincomalee, has offered Rs. 50 in connection with this Show, to be distributed in prizes, and the Government Agent a prize of Rs. 10 to be awarded to the best paddy exhibited under section I., Cereals.

The Kandy Agri-Horticultural Show. -There will be no Show held in Kandy this year. It was agreed at a meeting held on the 5th January that the Kandy Show be held during *perahera* time in July-August, 1908.

Matale Agricultural Show.—A meeting of the Matale Show Committee was held on the 26th instant, when Friday and Saturday, the 21st and 22nd June, 1907, were decided upon as the dates for holding the Show.

Weekly Market Fair at Minuwangoda.—The Minuwangoda Branch Society, which was the originator of Market Fairs, has started a Weekly Fair on Saturdays from 6 a.m. to 5 p.m. The Fair is held in the Gansabhawa garden known as "Ellis Court." A notice issued in this connection by the Branch says:—"All persons concerned have the permission of the Society to make use of the "Ellis Court," without any charges, to expose for sale vegetables, fruits, mats, yams, pottery, silver, gold, and brasswares, iron work, rice, oils, ghee, butter, copra, cinnamon, clothes, and all commodities of trade. Persons attending the Fair from Colombo, Negombo, and distant places have ample accommodation in the town where there are hotels and eating-houses and easy railway communication from Henaratgoda and Veyangoda."

The Etlaiyapuram Samasthanam Exhibition and Cattle Show, 1907.—The following notice has been issued by the Dewan of Ettaiyapuram with regard to this Exhibition :—Concession rates, *i.e.*, first class goods rates have been promised by the S. I. R. and M. R. for exhibits, on production of certificates which will be supplied on application.

The Shows fixed for this year are as follows :—

Telijjawila	March 15
Trincomalee (Market Fair)	April 2
Nuwara Eliya	April 2 and 3
Batticaloa	(No date fixed)
Uva (Badulla)	May (early)
Welimada (Market Fair)	May
Matale	June 21 and 22,

Experimenl in Scientific Manuring.—Messrs. Freudenberg & Co. have sent a supply of artifical manure to be experimented with on coconut, orange, mango, and mangosteen trees by the *Panadure* Branch.

The *Telijjawila* Branch has also applied for supplies for similar experiments on coconut and various fruit trees.

Beans from Welimada.—Mr. N. P. R. Coorey, a member of the Society and also of the Branch Society at Welimada, reports that seeds of *tree* and *white wax beans* grown in the Welimada district are now available. He thinks that these seeds are particularly suited to the Western, North-Central, North-Western, and Southern Provinces. The beans can be obtained on applicaton to Mr. Coorey, at 65 cents per lb. for tree beans and Re. 1 for white wax beans; post free.

Fruit Trees for Telijjawila.—The following varieties of fruit trees have been supplied to the Telijjawila Branch from the Royal Botanic Gardens, Peradeniya:—Avocado pear, loquat, sapodilla, star apple, granadilla, custard apple.

Banku Paddy.—Referring to the Banku seed paddy imported from India, the Hon. Secretary of the Jaffna Branch reports that "None of the seed germinated, though it was put in the hands of experienced cultivators. The opinion of those who conducted the experiment is that the paddy was from the first unfit to be used as seed." The Society will be glad to receive reports from other members who tried this paddy in other districts in view of the total failure reported from Jaffna.

Sixty-days Seed Paddy.—An application for seed paddy has been received from Mudaliyar G. E. Weerakoon, Tangalla, who wishes to try the sixty-days variety in his district. Arrangements are being made for obtaining a supply.

Cotton and Camphor Cultivation in Badulla District.—A proposal has been made that scientific opinion be obtained as to whether cotton and camphor cultivation is probable in Badulla District so that these cultivations may be taken up on a large scale. It is also proposed to make an experiment in growing tobacco in some districts of Uva.

Castration of Cattle.—Printed copies of the annual report by the Government Veterinary Surgeon on the work done by his Department during 1906 in connection with the castration of cattle will be circulated at this meeting. The report deals fully with the work done by the Society in this connection. From 1905 to end of 1906 there were 197 demonstrations held in different centres, at which 4,384 cattle belonging to 3,470 owners were operated upon and 179 men trained to perform the operation.

The men trained in the local centres have been in most cases furnished with implements and drugs from Village Committee funds, and they have been employed in different districts. The following figures indicate the work done by them in the centres named:—Wanni hatpattu 432, Puttalam 7, Hambantota 10, Pata Dumbara 13, Matara Gravets 99, Panadure 40, Delft 34, Harispattu 6, Wellaboda pattu (Galle) and Horrekelly estate. Figures for the last two are not to hand.

Publications.—The Editor of the "Sihala Samaya," as usual, kindly forwarded 50 copies of his paper containing a translation of the proceedings of the last meeting of the Board; these were distributed among Branch Societies.

A complete list of members of the Society up to January, 1907, has been compiled and printed, and is now being issued to members.

A leaflet on "Experiments in Rotations of Crops on Chena" is now being prepared by the Director of the Royal Botanic Gardens, and will be printed in English and the vernacular languages and issued to members.

T. A. CAREY,

February 4th, 1907. *Secretary, Ceylon Agricultural Society.*